Art. VII.—*A Revision of the Fossil Fauna of the Table Cape Beds, Tasmania, with Descriptions of the New Species.*

(Plates II., III., IV.).

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The present paper is the outcome of the study of the very fine collection of fossils from the Table Cape beds made by Mr. E. D. Atkinson. The collection was some short time ago left in the charge of Mr. C. French, Government Entomologist, through whose kindness and influence the request of Professor Spencer that the collection should be deposited on loan in the Biological Museum at the Melbourne University, to be named and worked out, was at once complied with. I have to thank these gentlemen for allowing me the privilege of attempting the work. The collection is made up as follows:—Gastropoda, ninety-two species; Lamellibranchiata, thirty-nine species; Brachiopoda, seven species; Echinodermata, three species; Corals, three species; making a total of 144 species, including among the mollusca twenty new species and two new varieties, which are herein described.

I have given full references to each described species and remarks on the species where deemed necessary, and wherever I have departed from the usual identifications I have given my reasons in full for so doing.

During the study of the above I thought it well to find out what further material might be obtained from the collection from this locality presented by Mr. Gronow to the Ballarat School of Mines Museum, accordingly I obtained from Mr. Alex. Purdie, the present curator, a list of their fossils, which number fifty-one species, the more important of which, for my present purpose, were very kindly forwarded to me for examination. I tender Mr. Purdie my best thanks for his ready response.

Upon asking the former curator, Mr. F. M. Krausé, who was responsible for the naming of the Ballarat collection, he informed me that it was examined and named by himself.

There appear, however, to be only three additional species to those in the Atkinson collection, and these I have referred to in what follows.

Having gone so far, I have thought it well to add as an appendix as complete a list as possible of the records from these beds. This appended list includes 114 species, and in the classes I have not touched in this paper Mr. R. M. Johnston records twenty-three species. We have thus the grand total of 281 species referable to this horizon. The complete summary being—

Mammalia	1
Pisces	3
Cephalopoda	1
Gastropoda	153
Lamellibranchiata	65
Brachiopoda	17
Polyzoa	9
Echinodermata	3
Zoantharia	19
Foraminifera	10
	281

From this it can be seen that we have 219 species of mollusca proper, and included amongst these there are seven living species. As, however, two of the latter, namely, *Limopsis aurita* and *Chamostrea albida*, are exceedingly doubtful records, it is, I think, reasonable to leave them out of consideration for the present. Taking into account, then, the remaining five, the percentage of living species for these beds is just about a fourth over two per cent.

When it is taken into consideration that as many as twenty different living molluscan species have been recorded as occurring in these beds, and that subsequent examination of the shells has brought this list down to the above, we are not surprised at the confusion that has existed as to the age of the beds.

For the geological features of the Table Cape beds we are indebted to Mr. R. M. Johnston, who has given full details in his papers contributed to the Royal Society of Tasmania, yet when writing these papers he was in no wise certain as to the correct age to which they should be assigned.

In 1876* Mr. Johnston was of the opinion that sufficient was not then known of either the living or extinct forms, and on that account any attempt at classification would be premature and misleading.

In 1879† Mr. Johnston states :—"Of the testacea only about five per cent. are known to exist. This continual lessening of the percentage of living to extinct forms as our knowledge increases is most significant. According to the principle which has been adopted by Mr. Lyell, and through him by nearly all the English geologists, this low percentage of living representatives indicates rather more an eocene than a miocene age for our marine beds at Table Cape."

In 1884‡ the same author remarks :—"If we are not prepared to reject the *percentage* method in the determination of the great divisions of the tertiary period, we must assuredly refer the Table Cape beds not to the *miocene*, but to the *eocene* or "early dawn" of the tertiary period in Australia. Also : "The investigations carried on by Professor Tate and other indefatigable workers since that time [1879] have placed this matter beyond all reasonable doubt, and now there is every reason to believe that the Table Cape beds, with their Australian equivalents, mark the earliest dawn of the eocene period in Australia."

Yet following this, in 1887,§ and again in 1888,‖ Mr. Johnston seems to have had some misgivings, as he apparently could not then see his way clear to adopt any more definite classification for the Tasmanian tertiaries than that indicated by the introduction of such terms as palæogene and neogene.

From the percentage of living species herein stated it can, I think, be seen that we cannot do otherwise than regard these beds as of eocene age. I am also of the opinion that further investigation of the fauna of these beds will tend rather to lower

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* Proc. Roy. Soc. Tas., 1876, p. 89.
† *Op. cit.*, 1879, pp. 86, 87.
‡ *Op. cit.* 1884, p. 224.
§ *Op. cit.*, 1887, p. 135 *et seq.*
‖ Geology of Tasmania, p. 208 *et seq.*

than raise the percentage of living forms, for it is a very noticeable and important fact that in the collection at present under examination, although it consists almost wholly of large species, there are upwards of twenty new forms included in less than 150 species. When the small shells are more thoroughly known, the list of species ought to be very materially increased; and judging from the fauna of similar beds in Victoria, the recent species are not likely to be largely increased, if at all.

Mr. Johnston's section* of the Table Cape beds is as follows:—Cap of recent basaltic tuff and wacke, 80 feet; calcareous sandstone and frequent bands, containing abundant remains of corals, echinoderms, and brachiopods, 78 feet; Crassatella bed, 80 feet, which apparently indicates a thickness of 158 feet for the marine beds; yet subsequently† the same author states that "nowhere along the Tasmanian coast does the marine group exceed 70 feet in thickness." I fail to comprehend what this means. The present collection of fossils came principally from the lower deposits locally known as the Crassatella bed, and judging from the fossils I regard this zone as the direct equivalent of the so-called middle beds of the Spring Creek section in Victoria. The coarseness of the material in which a number of the Table Cape fossils is preserved, the worn character of many of the species, and the abundance of fragments of shells, clearly indicate the littoral character of the deposit, and as an attendant fact of some importance we have certain faunal characteristics indicative of the same feature. On the other hand the clayey portions at least of this zone at Spring Creek do not appear to have been quite so close to land, as evidenced by the finer sediments, and the absence hitherto of any specially littoral fossil forms. The comparatively slight differences existing between these two representatives of what I regard as the same zone appear to me to be adequately accounted for by the fact that the one set of deposits was laid down very much closer to the then existing shore line than the other.

Another representative of this horizon in Victoria appears to be the clay beds of Cape Otway, as evidenced by the fossils

* Proc. Roy. Soc. Tas., 1876, section opposite p. 90.

† Geology of Tasmania, pp. 244, 245.

recently recorded by Messrs. Tate and Dennant.* The upper calcareous sandy beds at Table Cape most probably belong to the same horizon as the Crassatella beds, merely showing a certain amount of lithological variation, a feature which is also well displayed in this zone at Spring Creek.

The types of the species described in this paper, unless otherwise stated, are at present deposited on loan in the Biological Museum of the University of Melbourne.

List of Abbreviations.

P.R.S.Tas. = Proceedings of the Royal Society of Tasmania.

P.R.S.N.S.W. = Proceedings of the Royal Society of New South Wales.

Trans. Phil. Soc., S.A. = Transactions of the Philosophical Society of Adelaide.

T.R.S.S.A. = Transactions of the Royal Society of South Australia.

Trans. N.Z. Inst. = Transactions of the New Zealand Institute.

A.M.N.H. = Annals and Magazine of Natural History.

Prod. Pal. Vic. = McCoy's Prodromus of the Palæontology of Victoria.

Geo. Tas. = Geology of Tasmania, 1888, by R. M. Johnston.

Q.J.G.S. = Quarterly Journal of the Geological Society of London.

Akad. d. Wiss. = K.K. Akademie der Wissenschaften, Wien.

Cat. Aust. Foss. = Catalogue of Australian Fossils, by R. Etheridge, jun.

Gast. I. = Transactions of the Royal Society of South Australia, vol. x., 1888. Gastropoda of the Older Tertiary of Australia, part i., by Professor Ralph Tate.

Gast. II. = *Op. cit.*, vol. xi., 1889, Gastropoda, part ii.

Gast. III. = *Op. cit.*, vol. xiii., part ii., 1890, Gastropoda, part iii. Plates deferred to vol. xv., part i., 1892.

Gast. IV. = *Op. cit.*, vol. xvii., part ii., 1893, Gastropoda, part iii.

Lam. I. = *Op. cit.*, vol. viii., 1886, Lamellibranchs, part i.

Lam. II. = *Op. cit.*, vol. ix., 1887, Lamellibranchs, part ii.

* Trans. Roy. Soc. S.A., 1895, vol. xix., pt. i., p. 3 *et seq.*

Table Cape Fossils.

GASTROPODA.

1. Murex (Pteronotus) calvus, Tate.

Id., Tate, Gast. I., 1888, p. 96, pl. i., fig. 11.

2. Murex (Phyllonotus) eyrei, T. Woods.

M. eyrei, T. Woods, P.R.S. Tas., 1876, p. 93.

M. (*Phyllonotus*) *eyrei*, Tate, Gast. I., 1888, p. 103, pl. iv., fig. 8.

M. eyrei, Johnston, Geo. Tas., 1888, p. 237.

Observations.—The shell figured by Mr. R. M. Johnston in his Geology of Tasmania, plate xxxi., figs. 3 and 3*a*, and referred to in the explanation of the plate as *M. eyrei*, T. Woods, is not that species, but may probably represent *Rapana aculeata*, Tate, which also occurs in the Table Cape beds.

3. Murex minutus, Johnston.

Id., Johnston, P.R.S. Tas., 1879, p. 32.

Id., Tate, Gast I., 1888, p. 107, pl. x., fig. 14.

Id., Johnston, Geo. Tas., 1888, p. 237, pl. xxix., fig. 7.

4. Typhis maccoyii, T. Woods.

T. maccoyii, T. Woods, P.R.S.Tas., 1875, p. 22, pl. i., fig. 5.

T. hebetatus, Hutton, Trans. N.Z. Inst., vol. ix., 1877, pl. xvi., fig. 1.

T. maccoyii, Tate, Gast. I., 1888, pp. 91, 92.

T. maccoyii, Johnston, Geo. Tas., 1888, p. 237, pl. xxix., fig. 11.

5. Rapana aculeata, Tate.

R. aculeata, Tate, Gast. I., p. 113, pl. ii., fig. 8.

Murex eyrei, R. M. Johnston (*non* T. Woods), Geo. Tas., pl. xxxi, figs. 3, 3*a*.,

6. Trophon selwyni, sp. nov. Plate II., fig. 7.

Shell small, rather thin, sometimes very thin and fragile, with an elevated and prominent acute spire of strongly convex and

costated whorls, ending in a full ventricose body-whorl with a comparatively large aperture, and with a very short twisted canal.

Apical angle about fifty to fifty-five degrees. Apex consists of about two smooth, well-defined convex embryonic whorls, with a centrally immersed tip. Embryonic whorls succeeded by five gradually increasing, markedly convex whorls, with a well-defined and somewhat impressed suture, occasional specimens being more constricted at the suture than the usual type. The greatest convexity about the middle of each whorl, with a tendency to shouldering at about the posterior third, as a consequence of the slope of the posterior third of each whorl being somewhat more sudden and flatter than the more regularly convexly rounded anterior two-thirds. Spire-whorls terminate in a broad ventricose body-whorl, with a rather large oval aperture.

Outer lip thin and sharp at the outer edge, slightly thicker internally, and bearing about twenty to twenty-two close, narrow, and short ridges in its full length from its junction with the anterior canal to the posterior suture. Inner lip very thin and concavely arched to the columella, the latter being rather strongly twisted. Canal very short, strongly bent to the left, finally somewhat reverted, and at the same time upwardly raised.

Surface ornamented with transverse costæ crossed by relatively coarse and fine spiral threads. The earlier half of the first spire-whorl is finely and very closely costate, bearing about five or six fine costæ. Subsequently the costæ become relatively broader and much wider apart. The ordinary costæ are narrow, with much broader interspaces between them, fade out before reaching the posterior suture, and usually developed right up to the anterior suture. In number they run from about nine to eleven to a whorl, and in some specimens show a tendency to become obsolete on the body-whorl. The costæ and interspaces are traversed by lines of growth and fine close striæ parallel to them. The transverse striæ are occasionally more noticeable on the posterior whorls, where they are sometimes sufficiently strong to give rise to a fine cancellated ornament by being crossed by the spiral threads. The whole of this transverse ornament is crossed by spiral threads, from five to seven of which are stouter than the remainder; and of these, three or four on the anterior slope of

each whorl are the stoutest and most prominent where they cross the costæ. Between the coarser threads is intercalated a finer thread which has a still finer thread on either side of it, more easily seen on the body and penultimate whorls than on the earlier spire whorls.

Dimensions.—Length, 16 mm.; breadth, 10 mm.; length of aperture, 6 mm.; breadth of aperture, 4 mm.; length of canal, 3 mm. Some of the Table Cape specimens are relatively smaller than given above, one of these examples giving the following dimensions:—length, 12 mm.; breadth, 7 mm.

Locality.—Not uncommon in the lower beds of the lower eocene of Spring Creek, near Geelong, Victoria. Also in the eocene beds of Table Cape, Tasmania, three examples.

Observations.—I am not at present wholly satisfied with the generic position of this species, but merely place it here tentatively whilst awaiting further examination of other material. The faint development in some specimens of what I cannot but regard as a tendency towards varices, taken together with the other characters displayed by the shell, seem certainly to indicate that it should be placed in the Muricidæ. It may at once be separated from any of our previously described tertiary species referred to this genus by its very short canal, its prominent spire, ventricose whorls, and the constricted suture. So far as the present specimens go, the Table Cape representatives seem to be hardly so ventricose in the body-whorl as those from Spring Creek, the difference in aspect being no doubt due to the fact that the costæ have become obsolete. In other respects the shells are in my opinion sufficiently close to be regarded as identical.

Species' name in honour of Sir A. R. C. Selwyn, late Director of the Geological Survey of Canada, and formerly Director of the Geological Survey of Victoria, to whom we are indebted for much of the best geological work done in this colony. Type specimen in my own collection.

7. Triton abbotti, T. Woods.

T. abbotti, T. Woods, P.R.S.Tas., 1874, p. 24, pl. i., fig. 8.

T. abbotti, Tate, Gast. I., 1888, p. 117.

Tritonium abbotti, Johnston, Geo. Tas., 1888, p. 237, pl. xxix., fig. 13.

8. Triton tortirostris, Tate.

T. minimum, T. Woods (non Hutton), P.R.S.Tas., 1876, p. 107.
T. tortirostris, Tate, Gast. I., 1888, p. 123, pl. v., fig. 7.
Tritonium minimum, Johnston, Geo. Tas., 1888, p. 237.

9. Fusus acanthostephes, Tate.

F. acanthostephes, Tate, Gast. I., 1888, p. 133, pl. vii., fig. 7.
F. spiniferus, Tate, *op. cit.*, p. 134, pl. vii., fig. 1.

Observations.—I have no hesitation whatever in regarding *F. spiniferus*, Tate, as a synonym of the above in view of my examination of a large series of specimens. Among the principal differences upon which Professor Tate has apparently relied for the specific distinction of *F. spiniferus* are the shorter spire, the variable apex, and the difference of ornament, particularly the absence of spiral ornament on the posterior slope of the whorls. The Table Cape specimens are a particularly interesting series, as some are ornamented in an exactly similar manner to *F. spiniferus* from the River Murray Cliffs, as proved by the comparison of actual specimens; but their spire is as long as that in the ordinary type of *F. acanthostephes*, and the embryonic whorls are also identical with those in the latter species. Other specimens approach *F. acanthostephes* in ornament and are important connecting links. A further examination of a large number of specimens from Muddy Creek and Mornington clearly and amply confirms the above conclusion, and it is at once seen that *F. acanthostephes* varies in the length of its spire, the fulness and size, and on that account appearance of the embryonic whorls, and in its ornament, to such an extent that *F. spiniferus* cannot possibly be regarded as specifically distinct.

10. Fusus meredithæ, T. Woods.

F. gracillimus, T. Woods (non Adams and Reeve), P.R.S. Tas., 1875, p. 22.
F. meredithiæ, T. Woods, *op. cit.* Explanation to pl. i., fig. 6.
F. meredithæ, Tate, Gast. I., 1888, p. 140.
F. meredithæ, Johnston, Geo. Tas., 1888, p. 237, pl. xxxi., fig. 9.

11. Fusus johnstoni, T. Woods.

F. johnstoni, T. Woods, P.R.S.Tas., 1876, p. 94.

F. johnstoni, Tate, Gast. I., 1888, p. 136, pl. xii., fig. 4*a*, 4*b*.

F. johnstoni, Johnston, Geo. Tas., 1888, p. 237, pl. xxix., fig. 9, and pl. xxxi., figs. 7, 8, 10 and 17.

12. Latirofusus cingulata, sp. nov. Plate II., figs. 5 and 6.

Shell elongate and narrowly fusiform, consisting of an obtuse embryonic portion of about two-and-a-half smooth convex whorls, the apex of which is central, succeeded by from six to eight gradually increasing very slightly convex whorls.

Apical angle from about twenty to twenty-five degrees. The smooth embryonic portion makes the apex of the shell obtuse, as its whorls are shorter, more convex, and slightly wider than the succeeding spire-whorl. Suture most distinct between the earlier or posterior spire-whorls, becoming less marked anteriorly; the convexity of the whorls also slightly stronger posteriorly, with a tendency to become flatter anteriorly, greatest convexity in the anterior half of each whorl. Aperture oval, peristome much thickened at the suture in adult specimens, outer lip with a thin, sharp and crenulated outer edge, thickened and ridged internally, about six well-defined widely separated internal ridges. Posterior of the aperture slightly channelled, anterior prolonged into a long narrow canal, which is a little more than one-third the length of the shell. Columella long and straight, and furnished at the anterior end of the aperture, just above the canal, with one strong oblique plait.

Surface ornamented with spiral threads crossed transversely by costæ, striæ, and lines of growth. Of the spiral threads there are four or sometimes five, which are strong, well-raised, and convexly rounded, with a much finer intercalated thread between, the latter, almost in some specimens and wholly in others, filling the intermediate space between the stronger spiral threads. The transverse ornament crossing the spiral consists, first, of close, regular, convexly-rounded costæ, about eight in number on the earlier or posterior whorls, increasing anteriorly to about fourteen on the body-whorl. The costæ are strongest about the middle of each whorl, and fade away towards the posterior and anterior

sutures. They are also stronger on the posterior whorls, becoming less distinctly defined anteriorly. Secondly, there are the lines of growth and the fine parallel striæ transverse to the spiral ornament.

Dimensions.—The Table Cape specimens are unfortunately imperfect examples, but the measurements which have been made are as follows : Length (apex and end of canal wanting), 22 mm. ; breadth, 7 mm. ; length of aperture, 4 mm. ; breadth of aperture, 2·5 mm ; length of canal (incomplete), 7 mm.

I happen to be fortunate enough to have some perfect though smaller and apparently younger examples of what I regard as the same species from the Spring Creek beds, near Geelong, and on account of their better state of preservation I make one of these specimens the type of the species, the following being its dimensions :—Length, 17 mm. ; breadth, 4 mm. ; length of aperture, 3 mm. ; breadth of aperture, 1·5 mm. ; length of canal, 7·5 mm.

Locality.—Eocene beds of Table Cape, Tasmania. Two examples. Also not uncommon in the lower beds of the lower eocene series of Spring Creek, near Geelong, Victoria.

Observations.—Up to the present time there has been only one described fossil species referred to this genus from the Australian tertiary deposits, and this has hitherto been obtained rather commonly from the eocene beds of Muddy Creek, Mornington, and from beds of equivalent horizon at several other Victorian localities. This form was originally described by Professor Tate under the name of *Fusus aciformis*, but was recently altered by him to *Latirofusus aciformis.** The present described species may be readily distinguished from *L. aciformis* by its smaller embryonic whorls, by the greater convexity of the spire-whorls, and by its very distinct ornament, having a few strong spiral threads with finer intercalated ones, and a distinct transverse costation, instead of the fine, cancellated ornament of *L. aciformis.* From the Parisian eocene fossils, and also from the living species referred to this genus, the present eocene form is, as far as I have been able to make out, specifically distinct. Type specimen in my own collection.

* Proc. Roy. Soc. N.S.W., 1893, p. 171.

13. **Clavella tateana**, T. Woods.

Fusus tateana, T. Woods, P.R.S.Tas., 1876, p. 94.

Fusus tateanus, Tate, Gast. I., 1888, p. 141, pl. xiii., fig. 5.

Fusus tateana, Johnston, Geo. Tas., 1888, p. 237, pl. xxix., fig. 6.

Clavilithes tateanus, Tate, P.R.S.N.S.W., 1893, p. 170.

14. **Pyrula altispira**, sp. nov. Plate III., figs. 2 and 3.

Shell pyriform, very thin, with a well-elevated obtuse spire, consisting of an embryonic portion of about three smooth, regularly convex, gradually increasing whorls, succeeded by four rapidly increasing ventricose whorls.

Apical angle about one hundred degrees. Earlier spire-whorls convex, penultimate slightly shouldered, body-whorl distinctly shouldered. In the neighbourhood of the aperture that part of the shell between the suture and the shoulder is almost perfectly flat, though gently sloping down to the shoulder, which is at a somewhat lower level than the suture; posteriorly this portion becomes gradually more and more convex, ultimately losing entirely the appearance it possesses near the aperture. Greatest width of body-whorl a little below the shoulder, thence gradually contracted to the somewhat long and arched canal. Aperture elongate and narrowly oval; outer lip simple and sharp, at the posterior end straight from the suture to the convexly rounded shoulder, thence gradually and regularly convexly arched to the anterior end of the canal. Columella simple, faintly enamelled, slightly arched to the right, then to the left. Canal long, rather wide, and slightly bent to the left. Surface ornamented with fine, regular, flatly rounded spiral threads, about ten in number in the space between the suture and the shoulder of the body-whorl, and about ten or twelve on the spire-whorls. On the body-whorl, at about its greatest breadth, the spiral threads are coarsest and reach nearly half a millimetre in thickness, thence anteriorly and posteriorly becoming much finer, ultimately very fine at the anterior end of the shell and just discernible on the posterior spire-whorl. Interspaces between the spiral threads about twice the width of the threads, flat and shallow. Both interspaces and spiral threads finely spirally striate, most notice-

able in the interspaces, which carry, where they are about one millimetre in width, five spiral striæ, distinct under a lens. At the anterior end of the shell there is occasionally a finer intercalated spiral thread developed. The spiral ornament is crossed transversely by lines of growth and by fine, strong, close-set striæ parallel to the lines of growth, thus completing the very fine, close, and neat ornament of this species.

Dimensions.—Type, length, 62 mm. ; breadth, 37 mm. ; length of aperture and canal, 54 mm. ; greatest breadth of aperture, 18 mm. A smaller specimen gives the following dimensions :— Length, 51 mm. ; breadth, 31 mm. ; length of aperture and canal, 43 mm. ; greatest breadth of aperture, 15 mm.

Locality.—Eocene beds of Table Cape, Tasmania. Two examples.

Observations.—No species of this genus have hitherto been described from our eocene beds, but the occurrence of the genus at Table Cape has been recorded by Professor Tate in his paper on the "Unrecorded Genera of the Older Tertiary Fauna of Australia"* in the following language :—"This genus is represented in the eocene beds of Table Cape, Tasmania, by a large species, known to me by two examples in the collection of Mr. T. Atkinson ; it is undescribed." The specimens referred to above by Professor Tate are those herein described. The elevated spire, the shouldered body-whorl, and the strong spiral ornament, are eminently characteristic of this species, and readily separate it from any of the living species with which I am at present acquainted.

15. Siphonalia roblini, T. Woods.

Fusus roblini, T. Woods, P.R.S.Tas., 1876, p. 22, pl. i., fig. 7.
Siphonalia roblini, Tate, Gast. I., 1888, p. 143.
Fusus roblini, Johnston, Geo. Tas., 1888, p. 237, pl. xxix., fig. 8.

16. Fasciolaria decipiens, Tate.

F. decipiens, Tate, Gast. I., 1888, p. 150, pl. viii., fig. 1.

Observations.—Professor Tate has already recognised (*loc. cit.*, pp. 60, 61) that the Table Cape form of this species differs in

* Proc. Roy. Soc. N.S.W., 1893, p. 173.

several respects from the typical form of *F. decipiens*, from Muddy Creek, and has suggested that it may be desirable when fuller material is at hand to apply distinctive names to them. The material now before me does not seem to justify more than a varietal distinction for the Table Cape form, which only differs from the ordinary Muddy Creek type of the species in that it has a shorter spire, and is a relatively broader and more ventricose form.

17. Peristernia transenna, T. Woods.

Fusus transennus, T. Woods, P.R.S.Tas., 1876, p. 94.

Peristernia transenna, Tate, Gast. I., 1888, p. 157, pl. xi., fig. 10.

18. Peristernia affinis, Tate.

P. affinis, Tate, Gast. I., 1888, p. 157, pl. xi., fig. 7.

19. Peristernia aldingensis, Tate.

P. aldingensis, Tate, Gast. I., 1888, p. 156, pl. viii., fig. 8*a*, 8*b*.

Observations.—I have very little hesitation in referring the present Table Cape specimens to the above Aldingan species, as I have made careful comparisons not only with Professor Tate's original description and figures of the shell, but also with actual examples of the species from the type locality. Judging, however, from the figures and the dimensions given by Professor Tate, and the specimens from Aldinga in my own collection, the Table Cape specimens are of larger dimensions and are much more solid shells, the dimensions of the latter being as follows :— Length (embryonic whorls and end of canal incomplete), 51 mm. ; breadth, 22 mm. ; length of aperture, 16 mm. ; breadth of aperture, 10 mm. ; length of canal (incomplete), 9 mm.

20. Peristernia murrayana, Tate, var. costata, var. nov.

Plate II., fig. 4.

P. murrayana, Tate, Gast. I., 1888, p. 155.

Observations.—There are ten examples of this shell in the collection, and after careful study I cannot regard it but as a variety of *P. murrayana*, Tate, a very common fossil in the

eocene beds of the River Murray Cliffs. I happen to have examples of this species from the type locality, as well as from some Victorian localities; and as these agree exactly in every particular with the original description and dimensions given by Professor Tate, I feel every confidence in drawing attention to some of the characteristics of the Table Cape form, which shows a sufficient divergence from the typical Murray Cliffs shell to warrant its recognition as an unrecorded variation to which this species is liable.

The whorls of the Table Cape shell are not so distinctly angulated, and instead of being only tuberculated at the anterior suture of the spire-whorls and at the periphery of the body-whorl, the tubercles are extended into distinct and slightly sigmoidal costæ, which are most highly elevated about the middle of each whorl. The costæ also appear to become more numerous than the tubercles, for Professor Tate states "tubercles small, eight to a whorl," whereas in the present form the costæ increase from about eight in number on the posterior whorl to twelve or thirteen on the body-whorl.

The ornament of the Table Cape shell may be described as follows:—Spiral ornament consisting of a few strong spiral threads with several finer threads intercalated between them. Each whorl bearing from about eight to twelve prominent threads, the three or four on the anterior portion of each whorl usually being the most prominent, with five much finer threads in the interspaces between; of the latter threads the middle one is much stronger than the other two on either side of it. The spiral ornament is crossed transversely by lines of growth, fine sigmoid striæ, and distinct costæ.

The spiral ornament of the Murray Cliffs shell is identical with the above, though one would not be able to judge so with certainty by comparison with the original description instead of with actual specimens.

The dimensions of the largest and best-preserved example from Table Cape are as follows:—Length, 34 mm.; breadth, 16 mm.; length of aperture, 11 mm.; breadth of aperture, 7 mm.; length of canal, 11 mm.

21. **Peristernia semiundulata**, sp. nov. Plate II., figs. 10 and 11.

Shell small, ovately fusiform, moderately thick, with convex or subangulated and strongly costated whorls, and a compatively short canal.

Apical angle about fifty degrees. Embryo consisting of about two-and-a-half convex whorls, the apex of which is slightly excentric. The anterior fourth of the last embryonic whorl, just before joining the first spire-whorl, is closely and slenderly costate, the costæ numbering about six or seven, gradually strengthening anteriorly, the remainder of the embryo being smooth. The spire consists of five very gradually increasing, convex, but occasionally subangulated whorls, with a well-defined and undulating suture. Aperture oval, outer lip thin at the outer edge, but rapidly thickening internally, where it is strongly ridged from the anterior canal to the suture, bearing in this space about twelve or thirteen long ridges, the shallow interspaces being about twice the width of the ridges. Columella bearing one oblique plait at the anterior end of the aperture. Canal somewhat short, very slightly bent to the left and faintly recurved.

Surface ornamented with transverse costæ, striæ, and lines of growth closely crossed by spiral threads. The costæ are well elevated and strongest in the anterior half of each whorl, close set, and convexly rounded, the interspaces usually narrower than the costæ. In number the costæ increase from nine on the posterior whorl to twelve or thirteen on the body-whorl, and are traversed by parallel lines of growth and fine striæ, the latter being usually most noticeable on the posterior slope of each whorl. The transverse ornament is crossed by spiral threads, of which there are about four stronger than the rest developed on the anterior portion of each whorl, and the posterior slope usually bears about three or four finer regularly undulating threads, and in the interspaces there are five much finer threads, of which the middle one is stronger than the pair on either side of it. The intercalated threads are, as a rule, more distinctly visible on the anterior than on the posterior of the whorls. Body-whorl with about twelve of the stronger threads, and with the finer intercalations as above.

Dimensions.—Length, 16 mm.; breadth, 8 mm.; length of aperture, 4·5 mm.; breadth of aperture, 3 mm.; length of canal, 4 mm.

Locality.—Eocene beds of Table Cape, Tasmania. Three examples. Also in the lower eocene beds of Spring Creek, near Geelong, Victoria.

Observations.—The present species apparently shows more affinity with *P. affinis*, Tate, from the same beds than any other hitherto described species, as far as I can make out, but owing to the very brief original description of this species it was not an easy matter to fix its representatives with certainty. From the specimens in the present collection I have identified as *P. affinis* the present described species differs in that the whorls are slightly more convex, the costæ do not extend from suture to suture, but fade away before reaching the posterior suture, the costæ are broader, and on that account appear more crowded, the stronger spiral threads are finer and closer together, and the intercalated finer threads are fewer and not of a uniform size, as in *P. affinis*, which has six or seven fine intercalated threads of uniform size. Further, in *P. affinis* the transverse striæ are much more strongly developed, being nearly as strong as the intercalated threads, thus giving rise to a very fine, neat, and regular cancellation ; also the crossing of the regular and narrow costæ with the stout spiral threads gives rise to a coarse cancellation, which is entirely absent in the new species. Also the columella of the new species is more slender and the canal narrower. This new species shows a certain amount of variability in the number and development of its costæ, but the remainder of its characters appear to be fairly constant. In the Spring Creek representatives the costæ are as a rule fewer in number, ranging from about eight to eleven on the body-whorl.

22. Ricinula purpuroides, Johnston.

Ricinula purpuroides, Johnston, P.R.S.Tas, 1879, p. 33.
Pisania purpuroides, Tate, Gast. I., 1888, p. 165, pl. xi., fig. 6.
Ricinula purpuroides, Tate, P.R.S.N.S.W., 1893, p. 173.

23. Zemira præcursoria, Tate.

Id., Tate, Gast. I., 1888, pp. 163, 164, pl. xi., fig. 5.

24. Phos liræcostatus, T. Woods.

Cominella lyræcostata, T. Woods, P.R.S.Tas., 1876, p. 108.
Phos liræcostatus, Tate, Gast. I., p. 167, pl. xi., fig. 12.

25. **Lyria semiacuticostata**, sp. nov. Plate II., fig. 8.

Shell somewhat thin, ovate-fusiform, with a well-elevated acute spire, and with the anterior truncated at the end of the short broad canal.

Apical angle about fifty degrees. Spire consisting of a very small obtuse embryo of two-and-a-half smooth, gradually increasing, slightly convex whorls, the apex of which is central, succeeded by six or seven much more rapidly increasing, slightly convex and costated whorls, with a rather deeply impressed and well-defined suture. Spire-whorls somewhat shouldered at the suture, owing to the form of the transverse costæ, otherwise regularly convex, with their greatest convexity about the middle of each whorl.

Aperture oval, acute posteriorly, and opening into the short broad canal anteriorly; outer lip much thickened, smooth within, gently sloping from the suture, then more suddenly and obliquely inwards as it joins the anterior end of the canal; inner lip with an enamel coating which is thickest at the extremities, almost thinning out medially. Columella with three strong oblique plaits at the anterior end, the medial one being the strongest; these are succeeded by about twelve ridges, gradually diminishing towards the posterior end, the latter being furnished with a strong tooth-like projection a little below the junction of the outer lip with the body-whorl. Canal slightly bent to the right, then recurved.

Surface ornamented with slender, acute, very slightly oblique, transverse costæ, which are most regularly and strongly developed on the earlier or posterior spire-whorls, and tend to become obsolete on the body-whorl, though still visible in some specimens as short angular elevations in the neighbourhood of the suture. The costæ have a more gradual lateral slope on their left side than on their right, where they are much more abrupt, this feature being most noticeable at the posterior suture of each whorl, as it gives rise to the sharp angular terminations at this extremity. Towards their opposite extremity they tend to fade away entirely, as may be noticed on the penultimate and more so upon the body-whorl. In number the costæ are slightly variable, some specimens being more closely costate than others. In all

they increase in number from behind forward, there being about thirteen on the posterior spire-whorl, increasing to from twenty to twenty-seven on the body-whorl. Surface also marked transversely by lines of growth and by very fine parallel striæ.

Dimensions.—Type, length, 30 mm.; breadth, 14 mm.; length of aperture, 15 mm.; breadth of aperture, 5 mm. A larger specimen gives the following dimensions:—length, 36 mm.; breadth, 17 mm.; length of aperture, 18 mm.; breadth of aperture, 6 mm.; and the largest specimen yet to hand has a length of 43 mm., and a breadth of 20 mm.

Locality.—Eocene beds of Table Cape, Tasmania. Three examples. An undescribed species of Lyria has been obtained by Mr. J. Dennant from the lower eocene beds at Spring Creek, near Geelong, which is, I believe, a representative of the above species.

Observations.—Two species of this genus have already been described, *L. harpularia*, Tate, a common eocene shell, and *L. gemmata*, Tate, a rare miocene species. The present species makes the second eocene form and shows many features of general resemblance to our living *L. mitræformis*, from which, however, it is readily separable upon critical examination. The principal differences whereby our fossil may be distinguished from this living species are the less robust shell, the much smaller embryo, more acute spire, less convex whorls, shorter and narrower canal, and its slender, acute and gradually fading costæ, and the absence of spiral grooving at the anterior end of the body-whorl. From our previously described eocene shell, *L. harpularia*, Tate, it may be at once separated by its smaller embryo, more acute spire, less defined shouldering at the suture, non-persistent costæ, and the absence of the spiral striæ, which are usually most distinct at the anterior end of that species. From the miocene shell, *L. gemmata*, it is still further removed and admits of easy distinction, and on that account I think it is hardly necessary to draw attention to any special differential characters.

26. Voluta anticingulata, McCoy.

V. anticingulata, McCoy, Prod. Pal. Vic. Dec. I., pp. 24-26, pl. vi., figs. 2 to 4.

V. antiscalaris, Johnston (*non.* McCoy), Geo. Tas., 1888, p. 237, pl. xxx., figs. 5, 5*a*, 5*b*, and 8.

V. anticingulata, Tate, Gast. II., 1889, pp. 133, 134.

Observations.—The shell figured by Mr. R. M. Johnston in his Geology of Tasmania is undoubtedly *V. anticingulata*, McCoy, as has already been pointed out by Professor Tate when dealing with this species, and not *V. antiscalaris*, McCoy, which was the name attached by Mr. Johnston to his figure in the explanation of his plate. The record of *V. antiscalaris*, McCoy, must therefore be expunged from the list of Table Cape fossils. *V. anticingulata*, McCoy, is apparently very common at Table Cape, as I now have before me a very large series of specimens which show the same amount of variation in form and ornament as has already been pointed out by Sir F. McCoy as occurring in the specimens from the lower eocene beds of Spring Creek, near Geelong. Thus as the extremes of variation we have *V. anticingulata*, var. *indivisa*, McCoy, in which the subsutural sulcus is entirely absent, the ribs fewer and more sigmoidal, and the shell narrower than in the typical form of the species, also the body-whorl and ribs are often smooth owing to the absence of spiral striæ on that part of the shell; and the other varietal form, to which the name of *V. anticinguiata*, var. *persulcata*, McCoy, has been attached, is also well represented, though not so abundant as the preceding variety, and this is characterised by the more numerous and straighter ribs and by the very strongly developed spiral striæ present on the whole of the body-whorl and spire. Many intermediate forms leading up to these varieties are not of uncommon occurrence, which clearly shows that the way in which this species has been treated by Sir F. McCoy is most certainly correct.

27. Voluta weldii, T. Woods.

V. weldii, T. Woods, P.R.S.Tas., 1875, p. 24, pl. i., fig. 2.

V. weldii, Johnston, Geo. Tas., 1888, p. 237, pl. xxx., figs. 6, 6*a*, 6*b*.

V. weldii, Tate, Gast. II., 1889, pp. 134, 135.

Observations.—This species is also very common at Table Cape, and shows a considerable amount of variation in form, and especially in the thickness of the shell, the width of the

body-whorl, and in the development of the nodulations on the angulation of the whorls, in some forms being very faint or almost entirely absent, while in others they are very strongly marked.

28. Voluta strophodon, var. stolida, Johnston.

V. strophodon, McCoy, Prod. Pal. Vic. Dec. IV., pp. 25, 26, pl. xxxvii., figs. 2–4*c*.

V. stolida, Johnston, P.R.S.Tas., 1880, p. 36, and Geo. Tas., 1888, p. 237, pl. xxx., figs. 4, 4*a* and 7 (*V. weldii*, Johnston).

V. strophodon, Tate, Gast. II., 1889, p. 134.

Observations.—Mr. Johnston in the work quoted above figures a shell (pl. xxx., fig. 7) as *V. weldii*, T. Woods, which is clearly not that species. Professor Tate apparently regards it as *V. strophodon*, McCoy ; for my own part I regard it as the young of Johnston's *V. stolida*, figured on the same plate. With regard to *V. stolida*, Johnston, Professor Tate places it amongst the list of unclassified species in his Gastropoda, Part II., p. 121, and merely remarks that it is related to *V. strophodon*. With this I agree, but as the shell shows distinct variation from the typical form of *V. strophodon*, as figured by Sir F. McCoy, it seems to me to be the most satisfactory course at present to retain a varietal name for this form, and it is in this sense that I use Mr. Johnston's name *stolida*.

29. Voluta tateana, Johnston.

V. tateana, Johnston, P.R.S.Tas., 1879, p. 37, and Geo. Tas., 1888, pl. xxx., figs. 3, 3*a*.

V. tateana, Tate, Gast. II., 1889, p. 132, pl. ii., fig. 5.

30. Voluta mortoni, Tate.

Id., Tate, Gast. II., 1889, p. 124, pl. ix., figs. 1, 2.

31. Voluta stephensi, Johnston.

V. stephensi, Johnston, P.R.S.Tas., 1879, p. 35, and Geo. Tas., 1888, pl. xxx., fig. 1.

V. stephensi, Tate, Gast. II., 1889, p. 122.

Observations.—Professor Tate regards this species as being closely related to *V. heptagonalis* and *V. alticostata*, but, appa-

rently based upon Mr. Johnston's description, differing from them in that it occupies an intermediate position between the two with regard to proportions, in having a greater number of ribs on the body-whorl, which also increase more rapidly in number on the posterior whorls, and in the absence or indistinctness of spiral sculpture. The last mentioned difference does not exist, unless it be in very much rolled and beach-worn specimens. It must have been a very ill-preserved example that came under Mr. Johnston's notice to have enabled him to make such a statement, for the four specimens which I have had the opportunity of examining show strong spiral threads, which number about twenty-four on the posterior whorls, and usually a much finer thread is developed between the strong spiral threads.

32. Voluta ancilloides, Tate.

Id., Tate, Gast. II., 1889, p. 126, pl. iii., fig. 7.

33. Voluta maccoyii, T. Woods.

V. maccoyii, T. Woods, P.R.S.Tas., 1876, p. 95.

V. lirata, Johnston, P.R.S.Tas., 1879, p. 37, and Geo. Tas., 1888, pl. xxx., fig. 10 (*V. allporti*, Johnston, non 1880) (non *V. lirata*, Tate, Gast. II., 1889, p. 130, pl. ii., fig. 4).

V. agnewi, Johnston, Geo. Tas., 1888, pl. xxx., fig. 9 (non *V. agnewi*, Johnston, 1880).

V. maccoyii, Tate, Gast. II., 1889, p. 126, pl. ii., fig. 2.

V. polita, Tate, *op. cit.*, p. 127, pl. ii., fig. 7.

Observations.—Considerable confusion has existed with regard to this species, which may now, I think, be cleared up in the following manner. The Rev. J. E. T. Woods in 1876 described *Voluta maccoyii* from the Table Cape beds, and the species described by him is represented in the present collection by twelve examples. In his description he mentions that the whorls have "no other marks than the lines of growth." In some specimens, however, which cannot be separated from this species, some of the lines of growth on the posterior whorls are so much stronger than others that the shells are distinctly lirate posteriorly, at the same time every gradation may be traced between the smooth and lirate forms. Mr. R. M. Johnston in 1879 described

a volute from Table Cape under the name of *V. lirata;* some of the specimens I have of *V. maccoyii*, T. Woods, agree well with the description and dimensions given by Mr. Johnston, and I have therefore no hesitation whatever in regarding the shells before me as Mr. Johnston's species. In 1888 Mr. Johnston published his Geology of Tasmania, and in that work figures a number of Table Cape fossils, amongst which we have, on pl. xxx., fig. 10, a shell evidently intended for *V. lirata*, but for some unknown reason it is referred to in the explanation of the plate as *V. allporti*, Johnston; the latter shell, though somewhat vaguely described, is stated by the author of the species to be the largest volute in the Table Cape beds, somewhat resembling *V. macroptera*, McCoy, but without the wing-like extension of the lip. In view of the above, it is evident that the figure referred to cannot possibly represent *V. allporti*, whereas it agrees fairly well with the description of *V. lirata*.

Mr. Johnston also figures in the same work on pl. xxx., fig. 9, a shell which is called *V. agnewi*, Johnston, which can hardly be said to agree with this description of that species given in 1880. I am inclined to agree with Professor Tate that this figure may represent a form of *V. maccoyii*, T. Woods.

In 1889 Professor Tate figures and describes a shell under the name of *V. lirata*, Johnston, which is most distinctly not that species, but is undoubtedly the same species as that described by him as *V. costellifera*, the latter species being subject to a certain amount of variation in the length of its spire, the breadth of the body-whorl, and the strength or development of the ribs or liræ. *V. lirata*, Johnston, must therefore be expunged from the lists of fossils from the lower beds (eocene) of Muddy Creek, Victoria.

In the same year Professor Tate redescribes and figures *V. maccoyii*, T. Woods, and records it as occurring in the lower beds at Muddy Creek and in the blue clays at Schnapper Point. The Victorian fossil as a rule shows some points of variation from the typical Table Cape form in that it is generally a somewhat more fragile and slender shell, and only occasional specimens show faint transverse liræ on the posterior whorls.

Professor Tate also describes in the same work a shell under the name of *V. polita*, which I am unable to regard as specifically distinct from *V. maccoyii*, T. Woods. Professor Tate distin-

guishes the former from the latter entirely on account of it being proportionately broader, with more convex whorls, a larger though similar pullus, and the presence of five columellar plaits instead of four. After examining fifty-five examples of *V. maccoyii* from the Victorian beds, together with the twelve specimens from Table Cape, I find considerable variation in the proportion of length to breadth, in the convexity of the whorls, in the size of the pullus, and though four columellar plaits seem to be the usual number, I have nine examples of the slender form with five columellar plaits and one example of the broad form with four columellar plaits. It is hardly necessary to mention that, if extreme forms of this species be taken for comparison with one another, one might at first sight experience considerable difficulty in regarding them as the same species, but when a large series of specimens is critically and carefully examined, one is forced to the conclusion that the best method is to regard the species as a variable one, and when we see that this is not an uncommon feature in our Volutes—for example, *V. anticingulata*, McCoy, *V. antiscalaris*, McCoy, *V. strophodon*, McCoy, and *V. weldii*, T. Woods—considerable strength is lent to this conclusion.

34. Voluta pellita, Johnston.

Id., Johnston, P.R.S.Tas., 1879, p. 36, and Geo. Tas., 1888, pl. xxx., fig. 2.

Observations.—Professor Tate places this species in his unclassified list, remarking that it may possibly be *V. ancilloides*, Tate, or *V. macroptera*, McCoy. I cannot regard it as identical with either of these species. *V. ancilloides*, Tate, is a common Table Cape fossil, and the present species differs from it in a very marked manner in general habit and dimensions; the pullus is smaller, less convex, and has a prominently exsert tip; the spire is much more slender; the apertural characters are, however, of the same type in both species. I have not yet seen any examples of *V. macroptera*, McCoy, from the Table Cape beds. Professor Tate records this species based upon examples in the Hobart Museum. It is, however, just possible that imperfect examples of *V. pellita*, Johnston, may have been mistaken for this species. *V. pellita* differs from *V. macroptera* in that the whorls are not

so regularly convexly rounded, in the absence of the wing-like extension of the outer lip, which is thickened as in *V. ancilloides*, in the much smaller pullus and its more marked centrally exsert tip, and in the presence of fine spiral threads, which tend to become obsolete on the body-whorl. Of our other continental species, that to which it is most closely related, and with which it may ultimately prove to be identical, is *V. capitata*, Tate, founded upon one specimen said to have come from a well-sinking in the Murray desert. Apart from size, some of the principal points of divergence appear to be the greater number of turns in the pullus and the presence of an extra plait on the columella of *V. capitata*.

35. **Voluta spenceri**, sp. nov. Plate IV., figs. 1 and 2.

Shell large, moderately thick, broadly fusiform, with an obtusely rounded mammilate apex, and a few strongly nodose and angular whorls, ending in a long and comparatively narrow aperture.

Apical angle about fifty-five degrees. The mammilate embryo consists of about two smooth convex whorls, which are enrolled obliquely, the apex being excentrically immersed. Embryonic whorls narrower than the succeeding spire-whorl, and the axis of their enrolment makes an angle of about one hundred and forty-five degrees with the axis of enrolment of the spire-whorls. Spire consists of five very rapidly increasing strongly nodose-angulose whorls. The angulation of the whorls is situated about the middle of each whorl, becoming slightly nearer the anterior suture anteriorly; the posterior slope is distinctly concave, as is also the case, but to a much less extent, with the more abrupt anterior slope. The posterior slope becomes less steep and more deeply concave as we proceed towards the body-whorl. Aperture elongate and narrowly oval, very acute and drawn out posteriorly, anterior end unfortunately incomplete in the specimens yet to hand. Outer lip very slightly thickened internally, thickest at the suture, near the outer edge it is gently rounded off from within, and ascends as high as the nodulations on the penultimate whorl, its outer margin being faintly undulatory. Inner lip rather thin, thickest near the posterior of the aperture, convexly arched to the columella. Columella slightly twisted and compara-

tively long, bearing a little below the middle of the aperture three unequally-sized oblique plaits, the anterior of which is the strongest. Earliest portion of spire-whorl at first only finely transversely striate, with very faint spiral threads, then bears fine and close transverse ridges or costæ, which become coarser and more nodulose in appearance anteriorly. From this onwards the whorls are strongly nodulose at the medial angulation, the nodules being closer and more numerous on the posterior whorls, where they number about twelve or fourteen, decreasing anteriorly, the body-whorl having only nine; with the decrease in number there is, however, a marked increase in strength and prominence. The nodulations are bluntly rounded, and, as a rule, slightly more abrupt on their right face than on the left, and on the penultimate and earlier part of the body-whorls are extended anteriorly into distinct bluntly rounded, faintly arching costæ, the last four nodules of the body-whorl not being thus extended. The whorls are also traversed by fine and close, yet distinct, transverse striæ and lines of growth, and are further ornamented by numerous (about twenty and upwards on the earlier whorls, increasing in number anteriorly) fine spiral threads with shallow, flat, intermediate furrows. The spiral threads tend to become obsolete on the anterior slope, being entirely absent from this part of the body-whorl, though still discernible on the posterior slope.

Dimensions.—Length (pullus and anterior end of canal incomplete), 100 mm; breadth, 60 mm.; length of aperture (incomplete), 66 mm.; breadth of aperture, 25 mm. In another specimen the pullus is 5 mm. high and 7 mm. broad.

Locality.—Eocene beds of Table Cape, Tasmania. One example (type). Also from the eocene clays of Curlewis, Bellarine Peninsula, Victoria.

Observations.—This species shows so many characteristic features of its own that it is at once separable from all our hitherto described fossil species, and I am unacquainted with any recent form to which it shows any close resemblance. Amongst our fossil species a certain amount of affinity may perhaps be made out with *V. stephensi*, Johnston; but from this it differs particularly on account of its smaller pullus, its broader form, different shaped whorls, the prominent nodules at the angulation, and also

some of the characters of the aperture. Specific name in honour of Professor W. Baldwin Spencer, of the Melbourne University.

36. Voluta atkinsoni, sp. nov. Plate III., fig. 1.

Shell large, with a mammilate apex and a short conical spire, succeeded by a very large, broad, and strongly shouldered body-whorl, bearing coarse oblique nodosities at the shoulder, with an aperture more than twice the length of the spire.

Apical angle about sixty degrees. Mammilate apex of about one-and-a-half smooth embryonic whorls, which are obliquely enrolled, extreme tip eroded in the example before me, but probably somewhat exsert from its appearance. Succeeding whorls five, suture defined, faintly undulatory, but not impressed. Spire very short, conical, with a slightly concave slope, rather suddenly expanded into the large broad body-whorl, which is nearly four times as long as the spire and a little more than twice as broad. Spire-whorls bearing short, broad, costæ-like nodules, which number about ten to a whorl, reaching from the anterior suture to about the middle of the whorls, thus making the anterior slope of these whorls a little convex, whereas the posterior slope is concave. Body-whorl strongly shouldered, posterior slope concave, anterior slope gently convexly sloping to the attenuated anterior end; on the shoulder there are ten strong oblique nodulations, some of which tend to extend down the whorl and develop into sigmoid costæ.

Aperture prolate-ovate, somewhat effuse anteriorly. Inner lip with a moderately thick enamel pad at the posterior end, posterior canal shallow and narrow; outer lip thick, bevelled off from within, with a moderate outward reflection and a steep and rapid ascent to the nodulations of the penultimate whorl; anterior end of margin where it joins the short and rather broad canal is a little shorter than the columella side. Columella long, stout, slightly twisted, bearing rather high up three unequally sized oblique plaits, the anterior of which is the strongest; the plaits are not easily seen from a front view, as they are situated well within the interior of the aperture.

Surface ornament in addition to the nodular characters already described consists of fine close spiral threads, with shallow inter-

vening furrows, on the spire-whorls, becoming obsolete on the body-whorl, also transverse lines of growth and fine parallel striations, which become more distinct and somewhat sigmoid on the body-whorl.

Dimensions.—Length, 133 mm.; breadth, 67 mm.; length of aperture, 92 mm.; breadth of aperture, 31 mm.

Locality.—Eocene beds of Table Cape, Tasmania.

Observations.—This very fine volute I have named as a compliment to Mr. E. D. Atkinson, whose careful and extensive collecting from the Table Cape beds has so enriched our knowledge of this particularly interesting fauna. This new species evidently belongs to that group of our eocene volutes typified by *V. hannafordi*, McCoy, but as it does not show any very close relationship to any of our hitherto described species, and has so many characteristic features of its own, any differential remarks seem to be at present unnecessary. There is, however, a very closely related if not identical form from the eocene beds of Birregurra, Victoria, procured by Mr. T. S. Hall from material from that locality; but at present I refrain from expressing an absolute opinion, in the hope that I may be able to obtain more specimens for closer examination.

37. **Voluta halli**, sp. nov. Plate II., figs. 1, 2 and 3.

Shell large, elongate-fusiform, with a small mammilate apex and a long slender spire, terminating in a large, elongate body-whorl, usually with a long and comparatively broad aperture ending in a short, broad canal. Well preserved examples still retaining a high polish.

Apical angle about forty degrees. Embryo mammillate, three to four millimetres in diameter, consisting of about one-and-a-half obliquely enrolled, smooth whorls, the axis of enrolment making an angle with the axis of the spire of about one hundred and forty degrees or slightly upwards. The apex of the embryo is prominently exsert and somewhat eccentric, the exsert portion being very sharply pointed and inclined towards the centre. The spire in the adult form consists of about eight gradually increasing whorls; the earlier spire-whorls are usually flat, occasionally very faintly convex, between the well-defined sutures,

becoming more convex anteriorly. Aperture elongate oval, somewhat effuse anteriorly, acute posteriorly, and with a short and very broad anterior canal. Outer lip thickened at the edge, slightly reflected outwardly and gently rounded off from within, ascending the penultimate whorl for a short distance, but barely reaching as high as the middle of that whorl. Outer lip has a fairly regular, convexly arched slope to the anterior canal, which it joins a little higher up than the opposite end of the columellar side. Inner lip thickest near the suture, where it forms a thickish enamel coating thinning out towards the columella. Columella comparatively long and slender, slightly twisted, and bearing at its upper part three strongly oblique plaits decreasing in strength posteriorly.

Earlier whorls ornamented with from about fifteen to twenty-five fine spiral threads, with narrower interspaces, the threads being stronger in the neighbourhood of the sutures than at the middle of the whorls, ultimately becoming obsolete anteriorly. The spiral ornament is crossed transversely by fine, close, and regular striæ parallel to the lines of growth, becoming more distinct as the spiral threads weaken and vanish. Body-whorl with very numerous striæ and slight undulations parallel to the lines of growth.

Dimensions—Length, 165 mm.; breadth, 67 mm.; length of aperture, 87 mm.; breadth of aperture, 40 mm.; breadth of anterior notch, 20 mm. The Table Cape representative in the present collection is a younger shell and has only attained the length of 110 mm. Young examples of this species are not at all uncommon, many examples of about 60 mm. in length and less being easily obtained at some of our Victorian localities. Taking the length as 100, the relative breadth varies from about 37 to 45, the latter being the above large example.

Locality.—Eocene beds of Table Cape, Tasmania. Common in the lower eocene beds at Spring Creek, near Geelong, also in the eocene clays of Curlewis, Bellarine Peninsula, Victoria.

Observations.—One of the adult specimens I have from Spring Creek, though very much the same as the above, still shows a few important characters which at present seem to warrant its recognition at least as a varietal form. Some of the principal features of this form being that the spire-whorls are a little more convex,

the penultimate whorl and the one preceding it are angulate or keeled about their middle line, the posterior slope being faintly concave, while the anterior slope is flat or slightly convex, the body-whorl is also shouldered, the aperture is narrower and less effuse, and the outer lip is not so distinctly reflected. In the main apparently similarly ornamented to the above on the earlier spire-whorls, but the body-whorl shows below the shoulder about eight or ten widely separated, obscure, very broad, and scarcely raised spiral ridges or bands, one of the strongest being near the anterior end of the whorl. The dimensions of a large example of this variety are: length, 157 mm.; breadth, 58 mm.; length of aperture, 90 mm.; breadth of aperture, 27 mm. It might be further mentioned that some of the young examples show a few widely separated spiral ridges about their periphery of a much stronger character than the earlier spiral threads. These young examples are also finely spirally threaded and grooved at their anterior end. The present species is somewhat related to *V. macroptera*, McCoy, but it is a very much more slender and flatter spired form, with a much smaller pullus, and no wing-like extension of the outer lip, which only slightly ascends the penultimate whorl, and is thickened at its outer edge. It also shows some relation to *V. pellita*, Johnston, but may be easily distinguished from that species by the smaller size of its pullus, its slender, elongate, and flat-whorled spire, and by its large, broad, and effuse aperture. Type in my own collection.

38. Voluta alticostata, Tate.

Id., Tate, Gast. II., 1889, p. 122, pl. v., fig. 7.

Observations.—A very fine entire representative of this species is in this collection, and as it has been compared with a perfect example of my own from Muddy Creek, the type locality of the species, there can be no doubt about its identity. However, as it is very much larger than any hitherto recorded example of the species, I think it well to record the dimensions, which are as follows:—Length, 185 mm.; breadth, 85 mm.; length of aperture, 110 mm.; breadth of aperture, 45 mm. A very much larger example of this species, being over a foot in length, is in the Melbourne National Museum, where it is labelled, though, as I think, erroneously, *Voluta hannafordi*, McCoy, and was obtained

from Muddy Creek. From the above there can be no doubt that this is the largest of our Australian Older Tertiary volutes as yet discovered.

39. Mitra dictua, T. Woods.

M. dictua, T. Woods, P.L.S.N.S.W., 1879, p. 8, pl. iii., fig. 7.
M. dictua, Tate, Gast. II., 1889, p. 137, pl. iv., fig. 9.

40. Mitra anticoronata, Johnston.

Id., Johnston, P.R.S.Tas., 1879, p. 34.

41. Ancillaria pseudaustralis, Tate.

A. australis, T. Woods (non. Sowerby), *fide* Tate, P.R.S.Tas., 1884, p. 209.

A. mucronata, T. Woods (non. Sowerby), P.R.S.Tas., 1874, p. 17.

A. mucronata, Johnston (non. Sowerby), Geo. Tas., 1888, pl. xxxi., fig. 12.

A. pseudaustralis, Tate, Gast. II., 1889, pp. 148, 149, pl. vi., fig. 13, and pl. vii., fig. 1.

Observations.—Not uncommon at Table Cape, but the abundant form which occurs is not the typical slender spired form so common in the lower beds at Muddy Creek and figured by Professor Tate on plate vii., fig. 1, in the work above referred to, but the very broad apically obtuse form recorded from a well-sinking in the Murray desert and from the River Murray cliffs, and figured by Professor Tate on plate vi., fig. 13.

42. Terebra additoides, T. Woods.

T. additoides, T. Woods, P.R.S.Tas., 1876, p. 95.
T. additoides, Tate, Gast. II., 1889, p. 163.

43. Terebra prægracilicostata, sp. nov. Plate II., fig. 9.

Shell small, narrowly elongate and very acute spiral, with small and convex embryonic whorls and rather flat and very slenderly costate spire-whorls, terminating with a narrow aperture and very short canal.

Apical angle about fifteen degrees. Embryo consists of about three smooth, regularly convex, gradually increasing whorls, the tip of which is central but not prominently exsert so far as the

present examination goes. Embryonic whorls succeeded by eight spire-whorls, which are slightly more convex posteriorly and become flatter anteriorly, with a moderately well-defined suture, but no well-marked subsutural groove or sulcus; anterior slope of body-whorl somewhat abrupt. Aperture narrow elongate-oval; outer lip thin and simple, somewhat thickened at the suture. Columella simple and slightly arched. Canal very short, comparatively wide, and a little upturned at the anterior end. At the base or anterior end of the shell a prominent ridge runs round from the anterior outer end of the canal just up to the columella.

Surface ornamented with very slender acute costæ, with much wider and shallow interspaces between. The interspaces become wider anteriorly, being about twice or slightly more than twice the width of the costæ on the body and penultimate whorls. The costæ are practically straight, very slightly elevated above the general surface of the shell, number twelve to a whorl and are smooth. Below the posterior suture of each whorl there is a tendency towards the development of a subsutural depression, which, however, has only affected the costæ, and the latter on this account appear faintly tuberculate in this region. The surface also shows fine lines of growth and striations parallel to the costæ, but the only spiral ornament consists of exceedingly faint and microscopic striations, which are not visible to the unaided eye.

Dimensions.—Length of eight whorls with embryo, 13 mm.; breadth of body-whorl, 3·5 mm.; length of aperture and canal, 3 mm.

Locality.—Eocene beds of Table Cape, Tasmania.

Observations.—This form seems at present sufficiently distinct from our previously described species of the genus to necessitate its record as new. It however shows some affinity with *T. additoides*, T. Woods, from beds of the same horizon, and with *T. leptospira*, Tate, from the eocene beds of Muddy Creek. From *T. additoides* it may be distinguished by its more slender and rapidly tapering spire, flatter whorls, much less numerous costæ (or plicæ as they are referred to in the description of that species), and the absence of the distinct subsutural band; and from *T. leptospira* it is also I believe distinct, but owing to the exceed-

ingly brief and vague description of this species I can only fall back on the accompanying figure for differential characters, and from this I judge that the present species differs in its embryonic characters, its more rapidly tapering spire, its slightly more convex whorls, and its much smaller number of different costæ or plicæ.

44. Semicassis sufflata, T. Woods.

Cassis sufflatus, T. Woods, P.R.S.Tas., 1876, pp. 93, 94.

Semicassis transenna, Tate, Gast II., 1889, p. 166, pl. viii., fig. 2.

Observations.—There seems no doubt that the shell described by Professor Tate under the name of *S. transenna* is the same species as that previously described by Tenison Woods under the name of *C. sufflatus*. The latter name should certainly stand, as it clearly has priority.

45. Cassidaria wilsoni, Tate.

Id., Tate, Gast. II., 1889, p. 169, pl. vii., fig. 14.

46. Marginella strombiformis, T. Woods.

M. strombiformis, T. Woods, P.R.S.Tas., 1876, p. 109.

M. strombiformis, Tate, Phil. Trans. S.A., 1878, p. 93.

M. strombiformis. Johnston, Geo. Tas., 1888, pl. xxxi., figs. 4, 4*a*.

47. Cypraea ovulatella, Tate.

Id., Tate, Gast. III., 1890, p. 208, pl. vi., figs. 7, 7*a*.

Observations.—The present example apparently differs only in size from that described by Professor Tate, being of nearly twice the dimensions given by him.

48. Cypraea archeri, T. Woods.

C. archeri, T. Woods, P.R.S.Tas., 1875, p. 23, pl. 1, fig. 9.

C. archeri, Tate, Gast. III., 1890, p. 205, pl. vi., fig. 1.

49. Cypraea platypyga, McCoy.

C. platypyga, McCoy, Prod. Pal. Vic., Dec. III., p. 39, pl. xxx., figs. 1–1*c*.

C. platypyga, Tate, Gast. III., 1890, p. 211.

50. Cypraea sphærodoma?, Tate.

Id., Tate, Gast. III., 1890, p. 209, pl. viii., fig. 5.

Observations.—It is with some hesitation that I record this species as occurring at Table Cape, owing to the incompleteness of the example before me, but after careful examination I have been unable to refer it to any other species.

51. Cypraea platyrhyncha, McCoy, var. angustior, var. nov. Plate IV., figs. 8 and 9.

C. platyrhyncha, McCoy, Prod. Pal. Vic., 1876, Dec. III., p. 40, pl. xxx., figs. 2–2*c*.

Observations.—As the common Table Cape shell shows some important departures from the type and usual form in the lower beds of Spring Creek, near Geelong, it seems to me advisable to regard these characters as of sufficient value for the introduction of a varietal name. Sir F. McCoy, when describing this species, has already remarked on some variation from the type form, for whereas the rostrum in the type is broad and flattened like a duck's bill, he has noticed narrower specimens, one or two which show a slight indication of the two anterior dorsal tubercles, and a variation in the number of teeth on the outer lip. The characters upon which I base this varietal name are the usually smaller size of the shell, the much more rapidly tapering and on that account narrower anterior end, the moderately strong development of the two anterior dorsal nodulations or tubercles, the less unequal growth and thickening of the two sides of the posterior canal, the direct effuseness over the spire of the posterior canal, the tendency to upturning of the anterior end and canal, and the stronger development and greater number of teeth on both lips. Sir F. McCoy's description of the mouth of *C. platyrhyncha* is as follows :—" . . . mouth narrow, flexuous, nearly edentulous, the posterior half and anterior fourth of both lips without teeth, the intervening quarter of the length of the outer lip having about twelve obtuse small teeth on the edge, the corresponding portion of inner lip with still smaller and fewer similar teeth, not extended as sulci over the base." In the present variety the anterior fourth of both lips is as above without teeth, but the remainder of the outer lip is toothed right up

to the posterior canal, and the teeth usually number about twenty-two; the inner lip in some specimens is also toothed for its full remaining length, with the same number of similar though smaller teeth, whereas in others they show a marked tendency to become obsolete at the posterior end. In one well-preserved example showing this tendency I have still been able to count sixteen distinctly visible teeth on this lip. All these points of difference are at first sight striking, and might be regarded as of specific value, but a close examination of a number of specimens will, I think, convince anyone that we are not dealing with more than an extreme form of *C. platyrhyncha*, McCoy.

Dimensions of var. angustior.—Length, 68 mm.; breadth, 33 mm.; height, 29 mm.; breadth at anterior end, 8 mm. Smaller specimens of about the following average dimensions also occur:—Length, 57 mm.; breadth, 28 mm.; height, 22 mm.; breadth at anterior end, 6·5 mm.

52. Conus complicatus, Tate.

Id., Tate, Gast. III., 1890, p. 195, pl. viii., fig. 8.

53. Daphnella gracillima, T. Woods.

Id., T. Woods, P.R.S.Tas., 1876, p. 106.

54. Bela tenuisculpta, T. Woods.

Daphnella tenuisculpta, T. Woods, P.R.S.Tas., 1876, p. 106.
Bela tenuisculpta, Tate, T.R.S.S.A., 1894, p. 221.

55. Raphitoma columbelloides, T. Woods.

Daphnella columbelloides, T. Woods, P.R.S.Tas., 1876, p. 105.
Pusionella columbelloides, Tate, T.R.S.S.A., 1894, p. 221.

56. Bela woodsii, Tate.

Cominella cancellata, T. Woods, P.R.S.Tas., 1876, pp. 107, 108.
Bela woodsii, Tate, Gast. I., 1888, pl. iv., fig. 3.

57. Pleurotoma paracantha, T. Woods.

Id., T. Woods, P.R.S.Tas., 1876, p. 105.

58. Pleurotoma johnstoni, T. Woods.

Id., T. Woods, P.R.S.Tas., 1876, p. 105.

Observations.—The Rev. J. E. Tenison Woods' description of this species is somewhat vague and difficult to grasp exactly, but I think that the present form represents his species; the specimens before me are however much larger than those indicated by his dimensions, having a length of 77 mm.; breadth, 22 mm.; length of aperture, 41 mm.; breadth of aperture, 9 mm.

59. **Pleurotoma wynyardensis**, sp. nov. Plate II., figs. 12 and 13.

Shell of small to medium size, somewhat narrow elongate-fusiform, aperture and canal about the same length as the spire; spire acute, made up of a rather small embryonic portion, succeeded by numerous, gradually increasing, convex, and more or less strongly costated whorls. Apical angle about twenty-five to thirty degrees. Embryo rather small, consisting of about one-and-a-half smooth convex whorls. Spire consisting of seven or eight regularly convex whorls, with their greatest convexity about the middle of each whorl, and with a well-impressed suture. Aperture oval; outer lip rather thin and smooth internally, with a well-defined broad but comparatively shallow sinus just below the suture, from the sinus the lip projects slightly forward with a regular convex arch, then curving downwards to join the anterior canal. Sinus about one to one-and-a-half millimetre broad, but usually only about half this measurement in depth. At the anterior end the aperture opens into a long, straight, slender and open canal, which is much longer than the aperture. Inner lip with a thin enamel coating. Columella simple and smooth, straight, slender, and gently tapering to the anterior end. Surface ornamented with oblique costæ, which are most highly elevated about the middle of each whorl, and fade off more rapidly towards the posterior suture than the anterior. Costæ usually nine to a whorl, an occasional example shows as many as eleven or twelve on the body-whorl. Strength of development of costæ somewhat variable, especially on the anterior whorls, where they are occasionally only just visible. The costæ are traversed by comparatively coarse and fine spiral threads. Of these there are four to six coarser and more prominent than the rest, situated in the anterior two-thirds of each whorl, especially prominent where they cross the costæ, more numerous, amounting to about eight or nine, on the body-whorl, with much broader interspaces between

each of which has a medial finer thread with a pair of still finer threads on either side of it. The posterior third is occupied by from about ten to fifteen very fine spiral threadlets, also the fine lines of growth of the sinus are in this space. Both costæ and spiral threads are traversed by the fine oblique forwardly directed lines of growth.

Dimensions.—Length, 27 mm.; breadth, 8 mm.; length of aperture, 6 mm.; breadth of aperture, 3 mm.; length of canal, 8 mm. Some of the young examples of this species in the collection have only attained the length of 13 mm.

Locality.—Not uncommon in the eocene beds of Table Cape, Tasmania, also in the lower beds of the lower eocene series at Spring Creek, near Geelong, Victoria.

Observations.—This species, as is commonly the case in the genus to which it belongs, shows a considerable range of variation, especially in the ornament. In the present form the costæ and spiral threads vary in number and in strength. In some examples the former become so weak on the anterior whorls that it would not be surprising, should examples subsequently turn up, in which the costæ had become altogether obsolete on the body-whorl. I am not at present acquainted with any living species which shows any marked affinity with the present form.

60. **Drilia crenularoides**, sp. nov. Plate III., figs. 6 and 7.

Shell moderately large, narrow-elongate, spire many-whorled and longer than the aperture and canal, whorls nodulosely costate, with a rather well marked subsutural concavity, sinus in this region well-defined, moderately broad and deep, canal rather short and straight.

Apical angle about twenty-five degrees. Embryonic whorls unfortunately missing. Spire consisting of about eight convex whorls, greatest convexity about the middle of each whorl, the posterior third of each whorl rather deeply concave immediately under the suture, which gives the appearance to this part of the shell of rather a strong overlap of the whorls, anterior two-thirds convex, most marked at the costæ.

Aperture oval, somewhat contracted posteriorly, and gradually drawn out anteriorly into a short, slightly curved and open canal, which is about the same length as the aperture. Outer lip thin and slightly crenulated at the outer edge with a very

distinct, broad and deep sinus just below the rather prominent subsutural band and situated in the concave posterior third. Sinus about half as deep again as broad, thence the outer lip projects prominently forward, then gently arched to join the anterior canal. Columella simple, slightly bent and tapering.

Posterior whorls ornamented with slightly oblique costæ, developed in the anterior two-thirds of the whorls and extending right up, though gradually fading, to the anterior suture, thus leaving the posterior third practically free from costulate elevations. On the anterior whorls the costæ fade sooner towards the anterior suture, though strongly elevated and prominent medially, giving rise to the appearance rather of a medial band of nodules or tubercles than to fully-developed costæ. Costæ or tubercles number about nine to a whorl. Spiral ornament consists of four or five strong spiral threads in the anterior two-thirds of each whorl, while the body-whorl shows about eight or nine, and one strong thread just adjacent to the posterior suture, making rather a prominent and characteristic subsutural band. On the posterior whorls the anterior group of threads are comparatively broad, with narrower grooves between, but anteriorly the grooves widen out till on the penultimate whorl the grooves or interspaces are broader than the threads, and become still more distinctly so on the body-whorl. As the grooves widen out much finer spiral threads become visible in this space, the interspaces on the body-whorl showing three of these finer intercalated threads. In the concave space between the subsutural band and the threads of the anterior portion of the whorl, which is occupied by the growth-lines of the sinus, there are two or three fine spiral threads, with still finer threads, just visible under a lens, on either side of them. The costæ and spiral ornament are both traversed by fine and close lines of growth, which by their marked sinuation and forward curvature clearly indicate the nature and position of the shell.

Dimensions.—Length, 24 mm. (without embryonic whorls); breadth, 8 mm.; length of aperture, 6 mm.; breadth of aperture, 3 mm.; length of canal, 6 mm.

Locality.—Eocene beds of Table Cape, Tasmania. An imperfect specimen from Spring Creek, Victoria, probably represents this species.

Observations.—This species recalls and apparently has some affinity to some of the forms of the living species, *D. crenularis*, Lamarck, from North Australia and Singapore, and the form to which it appears most closely related is that represented by Tryon in his Manual of Conchology, pl. x., fig. 69, from this it is separable principally by its narrower and slightly longer canal, more slender columella, fewer costæ, and different details of ornament.

61. Natica wintlei, T. Woods.

N. wintlei, T. Woods, P.R.S.Tas., 1875, p. 23, pl. i, fig. 3.
N. wintlei, Johnston, Geo. Tas., 1888, pl. xxix., fig. 10.
N. wintlei, Tate, Gast. IV., 1893, pp. 322, 323.

62. Natica subnoæ, Tate.

N. subnoæ, Tate, Gast. IV., 1893, p. 320, pl. vi., fig. 1.

63. Natica vixumbilicata, T. Woods.

N. ovata, T. Woods (*non* Hutton), P.R.S.Tas., 1875, p. 17.
N. vixumbilicata, T. Woods, *op. cit.*, 1876, p. 111.
N. vixumbilicata, Tate, Gast. IV., 1893, pp. 320, 321, pl. x., fig. 9.

64. Natica polita, T. Woods.

N. polita, T. Woods, P.R.S.Tas., 1875, p. 23, pl. i., fig. 4.
N. polita (*forma typica*), Tate, Gast. IV., 1893, p. 325.
N. polita, (*forma inflata*), Tate, *loc. cit.*

65. Natica, n. sp.

Observations.—This shell is only represented by one example in the present collection, and appears to be entirely distinct from any of our already recognised species; but taking into consideration the fact that most of our common fossil representatives of this genus are subject to no small amount of variation, I refrain from attaching a specific name and rearing up a new species upon this single specimen. The form now under examination may be said to show some affinity to *N. wintlei*, T. Woods, from the same beds, and to *N. aldingensis*, Tate, from the eocene beds of Aldinga, South Australia.

With some of the larger forms of *N. wintlei* it agrees somewhat in umbilical and apertural characters, but does not appear to have any funicular ridge or rib, a feature usually most noticeable in medium-sized specimens of that species. In the characters of this region it makes a closer approach to *N. aldingensis*, but the umbilicus is not so open or so deep. In the shape of the body-whorl it again approaches *N. aldingensis* rather than *N. wintlei*, but differs most markedly from both these species in its very short, small, and depressed spire of about the same number, though much more flattened and hidden whorls. I have not been able to make out any distinct spiral threading or ornament, but fine centrifugal lines of growth and parallel striæ are very well-marked on the spire and body-whorl.

66. Calyptræa subtabulata, Tate.

Trochita calyptræformis, Johnston (*non* Lamarck, *non* Deshayes) P.R.S.Tas., 1876, p. 86, and Geo. Tas., 1888, pl. xxix., figs. 14, 14*a*.

? Pileopsis navicelloides, Johnston, P.R.S.Tas., 1879, p. 39.

Calyptræa subtabulata, Tate, Gast. IV., 1893, p. 332, pl. vii., fig. 1.

67. Turritella warburtoni, T. Woods.

T. warburtoni, T. Woods, P.R.S.Tas., 1876, p. 99.

T. sturtii, T. Woods, *loc. cit.*

T. warburtoni, Tate, Gast. IV., 1893, pp. 337, 338, pl. viii., fig. 2.

T. sturtii, Tate, *loc. cit.*, pl. viii., fig. 6.

Observations.—Professor Tate's description of this species differs from the original description of Tenison Woods, noticeably in that the latter lays a certain amount of stress upon the presence of "*two smooth* conspicuous ribs at the lower part of each whorl, with others very fine and of varying size above;" whereas Professor Tate describes the species as bearing "two anterior ribs more or less granulose, each of the interspaces between the keels with two or three fine threads of varying size." It is evident from this that Professor Tate saw some variation in this species which he thought fit to draw attention to in the above manner. At the same time the fact has been overlooked

that the form described by Professor Tate under the name of *T. warburtoni* is intermediate between those described by Tenison Woods under the names of *T. warburtoni* and *T. sturtii*, the latter being characterised by Tenison Woods in the matter of ornament as follows :—"The three prominent ribs on the whorls are all granular, the larger two at the base of the whorl, and the third above and separated by a wide interval in which smaller ribs occur." Again, Professor Tate's description of *T. sturtii* differs from the original of T. Woods in that he remarks :—"Prominent ribs three, equidistant, of which the median and anterior ones are granulose, the posterior one often double, each interspace with about two fine spiral threads."

From the above remarks it can be readily seen that there is considerable variation in the ornamentation of these Turritellas, and Professor Tate's redescriptions of T. Woods' species, together with my own observations on a very large number of specimens (upwards of 150), constrains me to the belief that we are merely dealing with an extremely variable form, which would be better designated by the one name, *T. warburtoni*, T. Woods, than by an indefinite multiplication of species. The extreme difference in shape to which this species is subject is fairly well represented by Professor Tate's figures to Gastropoda, Part IV., pl. viii., figs. 2, 2*a*, 2*b*, and 6, 6*a*, 6*b*, but in a large series intermediate forms are not uncommon.

The apex is described by Professor Tate as consisting of "two-and-a-half smooth turns" in the one case (*T. warburtoni*) and "three small, smooth, rounded turns" in the other (*T. sturtii*). We are unable to compare this part of the description with that of T. Woods, as he simply says, in both instances, "apex always decollated."

As the specimens described by T. Woods under both these specific names were evidently imperfect examples, I cannot gain any reliable information as to the number of whorls. Professor Tate, however, states that *T. warburtoni* has fifteen whorls in a length of 9·5 mm., while T. *sturtii* has the same number of whorls in 12 mm. In my examination of apically perfect specimens I find considerable variation in the number of whorls in a definite length, and as would naturally be expected, the more acute varieties are those which possess the greatest number of

whorls. We have in this particular an exactly parallel case in the succeeding species, *T. murrayana*, and in the latter case it is extremely readily detected, as it is on a so much larger scale.

68. Turritella murrayana, Tate.

Torcula murrayana, Tate, P.R.S.Tas., 1884, p. 227.

Turritella murrayana, Tate, Gast. IV., 1893, pp. 340, 341, pl. viii., fig. 3.

Observations.—The variation to which this species is subject has already been dealt with to a certain extent by Professor Tate in his Part IV. of our Tertiary Gastropoda; but as my study of this collection of Table Cape Fossils has led to the consideration of forms varying beyond the limits already expressed, I think it well to include here the additional observations.

In the typical form, according to Professor Tate's description, there are twelve to fourteen whorls, an apical angle of about 15 deg., length 60 mm., breadth 17 mm. Professor Tate also notes that the Table Cape form is usually proportionately broader, the apical angle being as much as 18 deg. The specimens I now have under examination from the same locality show a much greater extreme in this direction, for in ten whorls the length is 86 mm. and the breadth 30 mm., while the apical angle is 22 deg. Another example of ten whorls, though still widely divergent from the type, shows a slight diminution in measurements from the preceding, in that its length is 70 mm., breadth 26 mm., and apical angle 21 degrees.

While dealing with this point it may not be out of place to record further variation in the opposite direction. In this case the specimens come from the eocene beds of Shelford, near Geelong, and are extremely slender, many-whorled forms, examples with sixteen whorls being 71 mm. in length, while only 15 mm. in breadth, and with an apical angle of only 12 degrees.

The above seems to my mind to give additional confirmation, if any were requisite, for the way in which I have dealt with *T. warburtoni*, T. Woods.

69. Turritella conspicabilis, Tate.

T. conspicabilis, Tate, Gast. IV., 1893, p. 339, pl. viii., fig. 7.

70. **Thylacodes rudis**, Tate.

T. rudis, Tate, Gast. IV., 1893, p. 343, pl. ix., fig. 8.

71. **Tenagodes occlusus**, T. Woods.

Tenagodus occlusus, T. Woods, P.R.S.Tas., 1876, p. 100.

72. **Potamides pyramidale**, Tate.

Id., Tate, P.R.S.Tas., 1884, p. 226.

73. **Potamides semicostatum**, Tate.

Id., Tate, P.R.S.Tas., 1884, p. 226.

74. **Rissoa dubia**, Johnston.

Id., Johnston, P.R.S.Tas., 1879, p. 33.

Observations.—Owing to the very brief description of this species it is a somewhat difficult matter to come to an absolutely definite conclusion; but the present specimen, after careful examination, I am unable to distinguish as distinct from Mr. Johnston's description, except that it is twice as large as the specimen of which he gives the dimensions.

75. **Astralium flindersi**, T. Woods.

A. (Calcar) *flindersi*, T. Woods, P.R.S.Tas., 1876, p. 95.

76. **Astralium ornatissimum**, T. Woods.

A. (Calcar) *ornatissimum*, T. Woods, P.R.S.Tas., 1876, p. 96.

77. **Astralium (Imperator) johnstoni**, sp. nov.

Imperator (Astralium) *imperiale?* R. M. Johnston, P.R.S.Tas., 1876, p. 90*c*.

Imperator hudsoniana, R. M. Johnston, Geo. Tas., 1888, pl. xxix., figs. 12, 12*a*.

Imperator tasmanica, R. M. Johnston, MS., *op. cit.*, p. 239.

Description.—Shell large, depressed trochiform, somewhat thick, consisting of a few flatly convex whorls, which are spirally ornate and strongly keeled, the keel bearing strong erect and forwardly projecting scales, and with a very deep umbilicus. Embryo

unknown, all the examples at present under examination being imperfect in this respect. Spire-whorls about four in number, rapidly increasing in size to the large and broad body-whorl, almost perfectly flat at first near the posterior suture, then flatly convex to the well-developed and characteristic keel, the latter being situated so close to the anterior suture that owing to its strong development and ornamentation the suture is completely hidden. Body-whorl keeled at the periphery, base almost flat, being slightly convexly rounded from the keel to the umbilicus. Aperture oval, nacreous internally, peristome almost continuous, but falls a little short at the posterior of the inner lip. Outer lip smooth internally, thin at the edge, and slightly crenulated at the ends of the coarse spiral threads; inner lip strongly reflected over the umbilicus. Umbilicus nearly circular, wide, and very deep, penetrating up the spire as far almost as the embryonic whorls, rather strongly angled by two revolving keels. The surface ornament consists of coarse and fine granulose or squamose spiral threads and a strong peripheral keel. The keel carries a number of stout, erect, forwardly projecting and very prominent scales, which are ornamented with fine threads in uniformity with those of the same degree of strength on the remainder of the shell. In a large specimen these peripheral scales number about twelve on the body-whorl, in smaller examples they are slightly less in number. Basal ornament consists of about six or seven coarse spiral threads, which bear numerous and comparatively coarse forwardly projecting scales, commonly, however, worn down to a more or less granulose appearance; intercalated between these are finer threads, which are similarly though not so coarsely ornamented. The spiral ornament is crossed by close, fine, and slightly raised lamellæ parallel to the lines of growth. Umbilicus partly margined by a revolving area, which only shows the lamellæ of growth, and partly by an area bearing spirally revolving threads similar to those above described.

Dimensions.—Height about 30 mm.; breadth to extremities of peripheral scales, 66 to 69 mm.; height of aperture, about 19 mm.; breadth of aperture, 27 mm.; width of umbilicus, 11 mm. Much smaller specimens occur having a basal diameter of from 32 mm. to 40 mm.

Locality.—Eocene, Table Cape, Tasmania. Also from the eocene ferruginous beds of Keilor (T. S. Hart), and Royal Park (Rev. Mr. Ramage), and from the eocene limestones (upper beds) of Moorabool Valley, at Maude.

Observations.—I have taken the liberty of describing and renaming this species owing to the very unsatisfactory and unrecognisable condition in which I find it. In the first place Mr. R. M. Johnston recorded with a doubt the occurrence of the living New Zealand species, *Astralium* (*Imperator*) *imperiale*, Chemnitz. This record in all probability refers to the present species, which, however, is undoubtedly distinct from its living analogue. When next we meet with an *Imperator* in Mr. Johnston's Geology of Tasmania, we find two figures on plate xxix. to which the name of *I. hudsoniana*, R. M. Johnston, is attached in the explanation of the plate; but upon looking up the list of Table Cape species given by the same author in the same work, the only *Imperator* there recorded is *I. tasmanica*, R. M. Johnston, MS. As I have been unable to find any description which goes with either of these names, and as the figures given of *I. hudsoniana* do not render its identification anything but a matter of extreme doubt, I have concluded to describe the shell and dedicate the species to Mr. R. M. Johnston.

The type specimens are in my own collection.

78. Liotia lamellosa, T. Woods.

L. lamellosa, T. Woods, P.R.S.Tas., 1876, pp. 96, 97.
L. lamellosa, Tate, *op. cit.*, 1884, p. 210.

79. Turbo etheridgei, T. Woods.

T. etheridgei, T. Woods, P.R.S.Tas., 1876, pp. 98, 99.

80. Turbo atkinsoni, sp. nov. Plate III., fig. 12.

Shell somewhat thick in the adult form, conical, nacreous internally, with a well-elevated spire; suture not well defined, being most distinct between the body and penultimate whorls. Base very slightly convexly rounded, thus giving rise to a somewhat abrupt convexity at the periphery of the body-whorl, most noticeable immediately above the mouth; the base as it ap-

proaches the anterior end of the mouth is more distinctly and regularly convex, and as a consequence the periphery of the body-whorl becomes less abruptly convexly rounded towards the outer lip of the shell.

Apical angle about sixty degrees. Whorls consisting of an embryonic portion of about a whorl and a half, succeeded by six rapidly increasing very slightly convex whorls. No umbilicus. Aperture oval, columella solid, arched and strongly nacreous, outer lip thick internally and bevelled off to a thin outer edge.

Spirally ornamented with strong, raised, rounded ridges, increasing from about three or four posteriorly to six on the body-whorl, separated from one another by a furrow about equal in breadth to the ridges. Both ridges and furrows very finely spirally striate and crossed transversely by close-set oblique lines of growth; at an average distance of about one millimetre the lines of growth become raised into lamellæ, which give rise to prominent, raised, forwardly projecting scales where they cross the spiral ridges. Base similarly ornamented with nine prominent, spiral, scaly ridges, but with the scales more numerous and closer together, also both ridges and furrows closely and minutely spirally striate.

Dimensions.—Type specimen, length, 28 mm.: breadth, 26 mm.; height of aperture, 8·5 mm.; breadth of aperture, 10 mm. Smaller specimen, height, about 25 mm.; breadth, 21 mm.

Locality.—Eocene beds of Table Cape, Tasmania. Three examples.

Observations.—This species differs from the previously described species, *T. etheridgei*, T. Woods, from these beds, to such an extent in shape, general aspect and ornament that I think it superfluous to enter into any detailed differential characters, and therefore refer to the above description in the hope that it may be found sufficient for the identification of the species. I am not at present acquainted with any other living or fossil species sufficiently closely related to the present fossil form to require any special remarks. Specific name in compliment to Mr. E. D. Atkinson, by whom it was collected from the Table Cape beds.

81. Thalotia alternata, T. Woods.

T. alternata, T. Woods, P.R.S.Tas., 1876, p. 97.

82. **Gibbula æquisulcata**, T. Woods.

G. æquisulcata, T. Woods, P.R.S.Tas., 1876, p. 98.

83. **Calliostoma tasmanica**, R. M. Johnston.

Zizyphinus tasmanicus, R. M. Johnston, P.R.S.Tas., 1879, p. 38.

84. **Calliostoma latecarina**, sp. nov. Plate III., figs. 10 and 11.

Shell small, trochiform, moderately thick, nacreous internally, strongly keeled at the periphery of the body-whorl, with a convex base below. Apical angle about sixty degrees. Apex small and somewhat obtuse, consisting of about one-and-a-half smooth, convex, embryonic whorls, the tip of which is central. The remainder of the shell consists of four somewhat flat to slightly convex and distinctly-shouldered whorls, the shouldering, owing to a marked flattening of the posterior slope in the neighbourhood of the suture, giving rise to the somewhat step-like appearance of the spire. The slope from the shoulder to the anterior suture on the spire-whorls usually only very slightly convex ; on the body-whorl convex to the strong keel, which runs out towards the lower part of the outer lip. Below the keel the base is convex to the aperture. Aperture quadrate, outer lip broken but probably thin at its outer edge ; inner lip nacreous, moderately thick, and reflected at the anterior end. Posterior slope between the shoulder and suture carries three fine spiral threads, the flat shallow interspaces between being about twice the width of the threads, and bearing about three much finer and just discernible spiral threads. Below the shoulder the interspaces become narrow and shallow spiral grooves, and the threads become broad and flat, about five or six of these strong threads on the spire-whorls, but on the body-whorl about three finer threads of the same character are noticeable on either side of the six stouter threads. By far the stoutest spiral band on the body-whorl is the keel, below which, that is on the base, there are eight or nine shallow spiral grooves, with broad flat ridges between, the latter tending to be subdivided into two anteriorly by the development of a finer groove along their middle.

Dimensions.—Length, 7 mm.; breadth, 6 mm.; breadth of aperture, 3 mm.

Locality.—Eocene beds of Table Cape, Tasmania.

85. Delphinula imparigranosa, sp. nov. Plate III., figs. 8 and 9.

Shell small, turbinate, convex basally, with a well-elevated spire consisting of a few convex, coarsely granulose whorls, somewhat thick and strong, with a wide and deep umbilicus.

Apical angle about seventy degrees. Embryo obtuse and broad, being about two millimetres across, and consisting of about two whorls, the second of which is distinctly angulose close to the anterior suture, and carrying one spiral band of fine granules between the angulation and the suture. Spire consists of about three rapidly increasing convex whorls, with an ill-defined suture. Aperture comparatively large and round; outer lip thick internally, but thin at the extreme outer edge, and slightly effuse at the four points where the four strongest spiral ridges of granules of the body-whorl cease, much more strongly effuse at the posterior and anterior of the aperture; inner lip very thin and slightly reflected towards the umbilicus, regularly arched on the aperture side, slightly biangulated by the presence of two ridges on the umbilical side. Umbilicus very wide and deep, only about half a millimetre narrower than the aperture, and penetrating a considerable distance beyond the posterior canal, and strongly margined by an acutely-angular granulose ridge running round from the anterior canal and joining the aperture as the second ridge below the suture.

Surface ornamented with coarse and fine granulose spiral ridges, traversed by very fine transverse striæ parallel to the lines of growth. There are three strong unequal granulose ridges to each whorl, the posterior ridge being made up of the coarsest and as a consequence smallest number of granules; the succeeding or middle ridge carries closer, slightly smaller, and therefore a larger number of granules, whilst those on the anterior ridge are still finer and more numerous. On the body-whorl the strongest granules become almost angular nodulosities. Further, between these variously granulose ridges there is a still finer intercalated one, with one or two even finer spiral threads

on either side of it. On the convex base of the body-whorl there is a fourth granulose ridge slightly finer than the third, and situated midway between it and the one margining the umbilicus, and on either side of this ridge there are three spiral threads, the middle one being the strongest, though only faintly granulose. The whole surface finely obliquely striate, the striæ being parallel to the outer margin of the aperture or to the lines of growth. Umbilicus with two faint spirally-angulose ridges and a few obscure intercalated threads and fine striæ parallel to the inner lip.

Dimensions.—Length, 8 mm.; breadth, 8 mm.; breadth of aperture, 3 mm.; length from suture to end of anterior canal, 5 mm.

Locality.—Eocene beds of Table Cape, Tasmania.

Observations.—At first I thought that this might possibly be *D. tetragonostoma*, T. Woods, but after careful consideration I have been unable to make it agree with the description of that species, the ornament particularly being markedly diverse from that expressed by the late Rev. J. E. T. Woods. The present species is, further, a much larger shell, though it is possible from the dimensions given of *D. tetragonostoma* that the latter species may have been founded on an immature shell. *D. tetragonostoma* is also stated to have some relation with the latticed Tasmanian *Liotias*, whereas the present form does not appear to me to show any such special resemblance.

86. Delphinula gibbuloides, T. Woods.

Solarium (*Torinia*) *gibbuloides*, T. Woods, P.R.S.Tas., 1876, pp. 97, 98.

Shell small, somewhat thick, broadly turbinate, somewhat depressed, with an obtuse apex, very large body-whorl, and a broad and deeply excavated umbilicus.

Apical angle about ninety degrees. Embryo obtuse, turbinate, consisting of about one-and-a-half smooth whorls, the second of which is slightly angulated. Spire-whorls three, flatly convex, with a deeply impressed suture between the earlier whorls, becoming less defined anteriorly. Body-whorl strongly keeled at the periphery, base convex to the well-elevated ridge margining the umbilicus. Aperture round; outer lip incomplete, smooth in-

ternally and probably thin at the outer edge; inner lip thin, slightly reflected towards the umbilicus and regularly concavely arched to the anterior canal, the latter being well-defined. Umbilicus very broad and deep, being a little broader than the aperture, and passing up more than half the height of the shell, strongly margined by a well-elevated ridge passing from the end of the anterior canal to a point a little below the suture of the body-whorl. Internally the umbilicus is finely striate and strongly angled by a revolving ridge, which starts from about the middle of the aperture, and a little higher up by another similar though very much fainter ridge.

Ornament consists first of the strong keel at the periphery of the body-whorl, but usually in juxtaposition to the anterior suture of the earlier whorls. This keel carries numerous erect, forwardly projecting spinose scales, which number about fifteen on the body-whorl. On the convex slope between the keel and the suture there are three unequally sized spiral bands of granules, the posterior band being made up of the coarsest granules. On the base between the keel and the thread margining the umbilicus is one prominent squamose spiral ridge with a much finer squamose thread on either side. Further, the shell is finely lamellosely-striate transversely.

Dimensions.—Length, 7 mm.; breadth, 8 mm.; breadth of aperture, 3 mm.

Observations.—After due consideration I have come to the conclusion that the shell I have described above is identical with that described by the late Rev. J. E. T. Woods under the name of *Solarium* (*Torinia*) *gibbuloides*, but as some of the features of the species have not already been very fully expressed, I take the opportunity of adding the above particulars in the hope that it may render its future identification less difficult. With regard to the generic location I prefer to place it under *Delphinula* as above, as its characters seem to point more clearly in that direction. In the original description it is stated that the shell is "conspicuously keeled, keel thin, finely granular, with irregular lines of rather larger granules above it." The herein-described form has very distinct forwardly-projecting scales on the keel and also on the succeeding ridge on the base, but not so prominent on the latter. These might, however, easily become worn or broken

off in such a manner as to leave the keel apparently granulose, and this may account for the above expression. In other respects I can see no difference between the original description and the form at present before me.

87. Haliotis ovinoides, McCoy.

H. ovinoides, McCoy, Prod. Pal. Vic., Dec. III., p. 24, pl. xxv., figs., 2, 2*b*.

88. Actæon puteolata, sp. nov. Plate IV., figs. 10, 11 and 12.

Shell small, oval, with a heterostrophe embryo, prominent and acute spire, somewhat elongate body-whorl, comparatively large and entire aperture, with a strong tooth near the posterior end of the columella, and a faint umbilical chink. Apical angle about thirty degrees. Embryo rather small, consisting of about one-and-a-half smooth convex whorls enrolled in one plane in the heterostrophe portion, which are partially hidden by being immersed in the succeeding whorl. Heterostrophe portion of embryo followed by about another half whorl, which is smooth and convex, and completes the embryonic whorls. Spire-whorls three to four, regularly convex, with a well-defined and slightly channelled suture; whorls gradually increasing at first but comparatively suddenly expanding into the much larger and somewhat elongate body-whorl. Aperture oval, entire, very little less than half the length of the shell, somewhat effuse anteriorly. Outer lip smooth internally, with a thin margin, the slight sutural channelling being most noticeable at its junction with the body-whorl. Inner lip concavely arched, reflected outwardly towards the anterior end. Columella bearing one stout oblique tooth, which is situated rather high up, being immediately opposite the very small and narrow umbilical chink, or slightly above the middle of the aperture. Spire-whorls ornamented with about twelve comparatively broad and flat spiral threads, with very narrow and shallow intervening grooves. On the body-whorl the spiral threads become more numerous, amounting to about twenty, and at the same time become considerably broader bands, and tend to be faintly subdivided by very much fainter, narrower, and

shallower spiral striæ or grooves than the principal ones. In the principal grooves very fine and close striations parallel to the lines of growth are distinctly visible under a lens, and as they do not appear to cross the spiral threads or bands they give rise to the rather characteristic appearance of pitting along these grooves.

Dimensions.—Type example, length, 4·5 mm.; breadth, 2·25 mm.

Locality.—Eocene beds of Table Cape, Tasmania.

Observations.—This species, which shows some relation to the shell previously described by the late Rev. J. E. T. Woods under the name of *Actæon scrobiculatus*, may possibly belong to the genus *Leucotina* of A. Adams, which was founded by that authority for the reception of living species in the Chinese and Japanese seas which are apparently of a somewhat similar type to our fossil form.

From *Actæon scrobiculatus* the present species may at once be separated, as it differs materially in shape and habit, having a relatively longer and more prominent spire, a more marked suture, shorter body-whorl, with one tooth-like plait towards the upper part of the columella instead of the strong obliquely twisted ridge towards the lower or anterior end of the aperture, and the distinct though small umbilicus.

89. Cylichna woodsii, Tate.

C. arachis, T. Woods (non Quoy and Gaimard), P.R.S.Tas., 1876, p. 102.

C. woodsii, Tate, P.R.S.Tas, 1884, pp. 211, 212 and 228.

90. Tugalia crassireticulata, sp. nov. Plate III., figs. 4 and 5.

Shell elongate oval, depressed patelliform, beak or umbo prominent and excentric posteriorly, situated at about one-third the length of the shell from the posterior margin. Greatest breadth (25 mm.) behind the beak across the middle line of the shell, narrowing much more rapidly anteriorly than posteriorly.

Margin coarsely denticulate, with a broad shallow sinus at the anterior end, otherwise almost perfectly flat; but close examination, when placed on a flat surface, shows a very slight lateral elevation, which is greatest at about the middle of each side, where it is very little more than about one millimetre.

Surface ornamented with coarse, gradually thickening ridges radiating in all directions from the umbo, alternate ridges slightly finer than the others, and with interspaces nearly as wide as the ridges. This ornament is crossed at distances of about one millimetre, or slightly less, by strong and regular concentric ridges, giving rise to a coarse reticulation over the whole surface. At the intersection of the radial and concentric ridging it is slightly nodulose when worn, but most likely somewhat squamose in the unworn condition.

Dimensions.—Antero-posterior diameter, 40 mm.; greatest breadth, 25 mm. at about 9 mm. in front of the umbo; height, 12 mm.; sinus, 5 mm. broad by about 1 mm. deep.

Locality.—Eocene beds of Table Cape, Tasmania. One example.

Observations.—This is the first species of this genus described from our Older Tertiary deposits, and it shows close relationship with the living *Tugalia parmophoidea*, Quoy and Gaimard, a not uncommon shell from the coasts of Tasmania, Victoria and South Australia. The present fossil species may however be distinguished from the living species, as it is of a different shape, being more regularly oval and its greatest breadth being anterior to the umbo; whereas the living species is broadest across or slightly posterior to the umbo, is proportionately broader and more suddenly rounded at the anterior end, and when placed on a flat surface the lateral margins are very much more highly and distinctly elevated. Further, the fossil species is much more coarsely ornamented and with coarser denticulations on the margin.

91. Entalis mantelli, Zittel.

Dentalium kicksii, McCoy, Woods, &c., see R. Etheridge, jun., Cat. Aust. Foss., p. 163.

Dentalium mantelli, Zittel, Pal. von Neu-Seeland, p. 45, pl. xiii., fig. 7, 1865.

Entalis mantelli, Tate, T.R.S.S.A., 1887, Scaphopoda, p. 190 (49 in Pamphlet).

92. Dentalium lacteum, Deshayes.

D. lacteum, T. Woods, P.R.S.Tas., 1874, p. 17.
D. lacteum, Tate, T.R.S.S.A., 1887 [1886], Scaphopoda, p. 193 (52 in Pamphlet).

LAMELLIBRANCHIATA.

93. Ostrea, sp.

Observations.—The specimens before me are not sufficiently well preserved, nor do they show sufficient characters to enable me to refer them to any definite specific name.

94. Placunanomia sella, Tate.

P. sella, Tate, Lam. I., 1886, p. 102, pl. v., figs. 1*a* to 1*c*.

95. Pecten yahlensis, T. Woods.

P. yahlensis, T. Woods, Trans. Phil. Soc. S.A., 1865, pl. i., fig. 4.
P. yahlensis, var. *semilævis*, McCoy, Prod. Pal. Vic., Dec. IV., pp. 13, 14, pl. xxxiv.
P. yahlensis, Tate, Lam. I., 1886, p. 110.

96. Pecten hochstetteri, Zittel.

P. hochstetteri, Zittel, Pal. von Neu-Seeland, p. 50, pl. xi., figs. 5*a* and 5*c* (non 5*b*, fide Tate), 1864.
P. pleuronectes, T. Woods (non Gmelin), Trans. Phil. Soc. S.A., 1865, pl. i., fig. 5.
P. hochstetteri, Hutton, Cat. Tert. Foss. N.Z., p. 30, 1873.
P. hochstetteri, Tate, Lam. I., 1886, p. 114.

97. Pecten foulcheri, T. Woods.

Pecten, sp., Sturt, Two Expeditions, p. 254, pl. iii., fig. 14.
P. foulcheri, T. Woods, Trans. Phil. Soc. S.A., 1865, pl. i., fig. 3.
P. foulcheri, Tate, Lam. I., 1886, p. 111.

98. Lima bassii, T. Woods.

L. bassii, T. Woods, P.R.S.Tas., 1876, p. 112.

L. bassii, Tate, Lam. I., 1886, p. 117, pl. v., fig. 8, and pl. viii., fig. 1.

99. Limatula jeffreysiana, Tate.

Lima (*Limatula*) *subauriculata*, T. Woods, (non Montfort), P.R.S.Tas., 1876, p. 113.

Lima jeffreysiana, Tate, P.R.S.Tas., 1884, pp. 213 and 230.

Lima (*Limatula*) *jeffreysiana*, Tate, Lam. I., 1886, p. 119, pl. iv., fig. 8.

100. Spondylus gæderopoides, McCoy.

S. gæderopoides, McCoy, Prod. Pal. Vic., Dec. IV., 1876, pp. 27, 28, pl. xxxviii., Dec. V., pl. xlv., figs. 1, 3.

S. gæderopoides, Tate, Lam. I., 1886, p. 121.

101. Nucula tenisoni, nom. mut.

Nucula tumida, T. Woods (non Hinds, non Phillipi), P.R.S.Tas., 1876, p. 111.

Nucula grayi, T. Woods (non D'Orbigny), P.R.S.Tas., 1877, p. 55.

Nucula tumida, Tate, Lam. I., 1886, p. 127, pl. vi., figs. 6*a*, 6*b*.

Observations.—I regret that I am at present unable to give as thorough an account of this species as I should like, but failing completeness the following are the facts that have been made out :—*Nucula grayi*, D'Orbigny, was recorded as a living Tasmanian shell by the late Rev. J. E. T. Woods in 1877, when he gave the following very brief description :—"Ovate, very transverse, acuminate at both ends, thin, inflated, very smooth, olive and shining. Very rare. Long Bay. Rev. H. D. Atkinson." This description seems to me to have an uncommonly Leda-like aspect and does not at all indicate to my mind a shell of the type of that now living in Port Phillip Bay, to which apparently, unfortunately, the name of *N. grayi* has become attached.

The original description as given by D'Orbigny in 1846 is as follows :—"N. testa ovali subtrigona lævigata crassa compressa, epidermide fuscoviridescenti ; latere buccali brevi, truncato,

complanato ; latere anali elongato subangulato. Longeur dix millimetres." I cannot regard this as identical with the shell described by Tenison Woods. I am also unable to make Sowerby's description of *N. grayi*, given in Reeve's Conchologia Iconica, fit our living species. The description given is as follows :—"Shell ovate, very transverse, slightly acuminated at both ends, thin, rather inflated, very smooth, olive ; posterior side produced ; dorsal area compressed, elevated sub-aliform, end acuminated ; anterior side a little produced, cuneated ; lunule short, defined." Recorded from South America by D'Orbigny and from New Zealand on the authority of Cuming. The Nucula at present living in Port Philip Bay is not at all uncommon when dredging about the neighbourhood of Brighton or Mordialloc. On several occasions living specimens have been obtained as well as numerous single valves. Having made very careful comparisons between this living species and our very common eocene and miocene, and, according to Professor Tate, also older pliocene fossil, I am forced to the conclusion that there is not the slightest difference between them worthy of the name, and I have therefore no hesitation whatever in again upholding their identity. A fact worthy of note, in my opinion, is that the Spring Creek fossils are those which show the most marked divergence from the living form, whereas those from the eocene beds of Muddy Creek and Mornington, which belong to a higher horizon in the series, according to the opinion held by Mr. T. S. Hall and myself, are absolutely identical, as is also the case with the miocene fossil, though it is noticeable that the latter reached somewhat larger dimensions than those hitherto obtained in the living state. The fossil form was first examined by the Rev J. E. T. Woods in 1876, when he described it as a new species under the name of *N. tumida*, remarking that it was "not unlike the Tasmanian *N. grayi*, Sow., but more tumid and conspicuously sulcate." Subsequently Professor Tate, when dealing with the Tertiary Lamellibranchs, accepted Tenison Woods' species and agreed with him as to its differences from the living Tasmanian species. Both the Rev. J. E. T. Woods and Professor Tate have, however, overlooked the fact that the name *Nucula tumida* had already been preoccupied by Mr. Hinds for a living shell obtained

whilst dredging in the Straits of Malacca.* So that under the circumstances it would hardly be wise to retain the name *N. tumida* for our fossil, as the living shell under that name is a very distinct species. Now, whatever may be the right name to apply to our living Nucula, I have very grave doubts about its identification with *N. grayi*, D'Orb., being correct, and I have up to the present been entirely unable to satisfy myself as to what it should be. Our fossil form, in my opinion, must participate in the same name as the living form, and as vagueness and uncertainty surrounds the latter, and as the former is obviously in want of a name, the simplest way out of the difficulty for the present, though perhaps not the wisest, is to propose for our common fossil, figured and described in the above quoted works, the new name of *Nucula tenisoni*, the specific name attached being a tribute to the late Rev. J. E. T. Woods, whose researches in Australian Tertiary Palæontology are well known to all colonial geologists.

102. Leda crebrecostata, T. Woods.

L. crebrecostata, T. Woods, P.R.S.Tas., 1876, p. 112.

Nuculana crebrecostata, R. Etheridge, jun., Cat. Aust. Foss., 1878, p. 155.

L. crebrecostata, Tate, Lam. I., 1886, p. 133, pl. v., figs. 5*a*, 5*b*.

103. Pectunculus cainozoicus, T. Woods.

Cucullæa cainozoica, T. Woods, P.R.S.Tas, 1876, p. 111.

Pectunculus cainozoicus, Tate, Lam. I., 1886, p. 136, pl. x., figs., 8*a*, 8*b*.

Id., R. M. Johnston, Geo. Tas., 1888, pl. xxxi., figs. 13, 13*a*, 13*b*.

104. Pectunculus laticostatus, Quoy and Gaimard.

P. laticostatus, Quoy and Gaimard, Voy. de l'Astrol., vol. iii., p. 466, pl. lxxvii., figs. 4–6, 1835.

P. laticostatus, McCoy, Prod. Pal. Vic., Dec. II., 1875, p. 26, pl. xix., figs. 10–14.

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*P.Z.S., 1843, p. 98, and Voy. H.M.S. "Sulphur," Mollusca, 1844, p. 63, pl. xviii., fig. 6.

P. maccoyii, R. M. Johnston, P.R.S.Tas., 1884, p. 199, and Geo. Tas., 1888, p. 235, pl. xxxi., figs. 1–1*d*.

P. laticostatus, Tate, Lam. I., 1886. p. 137.

P. maccoyii, Tate, *loc. cit.*

105. Cucullæa corioensis, McCoy.

C. corioensis, McCoy, Prod. Pal. Vic., Dec. III., 1876, p. 32, pl. xxvii., figs. 3–5*b*.

C. corioensis, Tate, Lam. I., 1886, p. 144.

C. coriensis, R. M. Johnston, Geo. Tas., 1888, p. 235, pl. xxix., figs. 4, 4*a*.

106. Trigonia semiundulata, McCoy.

T. semiundulata, McCoy, Geo. Mag., vol. iii., p. 481, and Prod. Pal. Vic., Dec. II., 1875, p. 22, pl. xix., figs. 4, 5.

T. semiundulata, Tate, Lam. I., 1886, p. 145.

T. semiundulata, R. M. Johnston, Geo. Tas., 1888, p. 235, pl. xxix., fig. 5.

107. Crassatella oblonga, T. Woods.

C. oblonga, T. Woods, P.R.S.Tas., 1875, p. 25, pl. ii., fig. 11.

C. oblonga, R. M. Johnston, Geo. Tas., p. 234, pl. xxix., figs. 1, 1*a*.

Observations.—This species is also recorded by Professor Tate as occurring in the miocene beds at Muddy Creek, Victoria, and in the oyster beds of the North-west Bend, River Murray. My examination of the Table Cape specimens enables me, however, to assert positively that the Muddy Creek shells are very distinct indeed, and the differences are such that to my mind they necesitate the description and renaming of the Victorian species, which I hope to undertake in my next palæontological paper.

108. Crassatella aphrodina, T. Woods.

C. aphrodina, T. Woods, P.R.S.Tas, 1875, p. 24, pl. iii., fig. 12.

C. aphrodina, Tate, Lam. I., 1886, p. 147.

C. aphrodina, R. M. Johnston, Geo. Tas., p. 234, pl. xxix., fig. 2.

Observations.—There is only one specimen among the Crassatellas before me which seems to correspond with the figures and

descriptions as referred to above, and in the absence of sufficient material I am unable to speak very definitely, but am somewhat inclined to think that this is hardly a valid species, and that it may prove to be but a varietal form of *C. oblonga*, T. Woods.

109. Mytilicardia platycostata, R. M. Johnston.

M. platycostata, R. M. Johnston, P.R.S.Tas., 1879, p. 40.
M. platycostata, Tate, Lam. I., 1886, p. 150.

110. Cardita gracilicostata, T. Woods.

C. gracilicostata, T. Woods, P.R.S Tas., 1876, p. 112.
C. gracilicostata, Tate, Lam. I., 1886, p. 152, pl. ii., figs. 6, 8.

Observations.—This species was recorded by Mr. J. Dennant in 1888 as occurring in the older beds at Muddy Creek, Victoria [T.R.S.S.A., vol. xi., 1888, p. 50]; subsequently Mr. T. S. Hall and I recorded it in our paper on the Older Tertiaries of the Southern Portion of the Moorabool Valley [P.R.S.Vic, vol. iv., n.s.], the identification being made for us by Mr. Dennant. Upon looking up the Moorabool Valley specimens so-named, I find that they were wrongly identified, and ought to have been regarded as *C. polynema*. In view of this I cannot but feel some doubt about the Muddy Creek record, which should, I think, be further confirmed or else withdrawn from the lists. It is satisfactory, however, that I am now in a position to record the occurrence of typical examples of *C. gracilicostata* from the eocene beds at Birregurra, whence it was obtained in material kindly forwarded to my friend Mr. T. S. Hall by Mr. Alex. Purnell. Having before me undoubted examples of the species from Table Cape, its type locality, and having made careful comparisons to the minutest detail between these and the Birregurra shell, I have no hesitation whatever in giving this as the only Victorian locality as yet known to me.

111. Cardita scabrosa, Tate.

Id., Tate, Lam. I., 1886, p. 152, pl. ii., fig. 4.

Observations.—The validity of this species is, I think, a matter of extreme doubt, and further investigation may prove that it is but a small form of *C. gracilicostata*, T. Woods. My attention

was drawn to this shell by the fact that a Table Cape specimen had been so named in the collection of the Ballarat School of Mines, and upon examination I found it to be identical with a form in the Atkinson collection which I had regarded merely as a young and well-preserved example of *C. gracilicostata*. Further, upon going over the descriptions and figures of these two species given by Professor Tate, their extreme closeness, if not absolute identity, seems to be apparent.

112. Cardita tasmanica, Tate.

Id., Tate, Lam. I., 1886, p. 154, pl. xii., fig. 13.

113. Lucina planatella, Tate.

Id., Tate, P.R.S.Tas., 1884, p. 229, and T.R.S.S.A., 1886, pl. xii., fig. 11, and Lam. II., p. 146.

114. Diplodonta subquadrata, Tate.

Id., Tate, Lam. II., 1887, p. 147, pl. xiv., figs. 10*a*, 10*b*.
Id., R. M. Johnston, Geo. Tas., p. 234, pl. xxxii., figs. 14, 14*a*.

115. Chama lamellifera, T. Woods.

Id., T. Woods, P.R.S.Tas., 1876, p. 114.
Id., Tate, Lam. II., 1887, p. 149, pl. xiv., fig. 5*a*, 5*b*.

Observations.—Tenison Woods, in giving the dimensions of this species, says :—"Largest specimens about lat. 24 by 22 and 18 mm. thick." Professor Tate states that they rarely exceed twenty millimetres of diameter. Several examples in the present collection do not conform to these dimensions, and a special feature of the majority is the extreme thickening of the shell. There are six examples above the dimensions given by Tenison Woods, ranging for their antero-posterior diameter from 25 mm. to 38 mm., and giving an average of a little over 30·5 mm., for their dorso-ventral diameter from 22 mm. to 29 mm., or an average of 25 mm., and in the thickness of the shell they run from 2 mm. to 8 mm.

116. Chamostrea albida, Lamarck.

C. albida, Lamarck, Anim. Sans. Vert., vol. vi., p. 96, 1819.
C. crassa, Tate, P.R.S.Tas., 1884, p. 228.

C. albida, Tate, Lam. II., 1887, p. 149.

Observations.—A single left valve of this species has been already recorded from the eocene beds of Table Cape on the authority of Professor Tate, founded upon a specimen collected by Mr. R. M. Johnston. There is a single right valve in the present collection, the state of which gives rise to an element of doubt, and suggests the possibility that it may have accidentally become entangled in some of the detritus of the shore line. Upon questioning Mr. Atkinson as to where this shell was collected, he said that he could not be certain that it was obtained *in situ*, and thought that it might probably have been included from beach material. I shall be very glad to receive any further information which may tend to prove or disprove with certainty the occurrence of this species as a fossil in these beds. Additional colour is lent to this doubt by the presence in the collection of the shelly tube of a marine worm, a living species, evidently included among the fossils accidentally, for it is still in a very fresh condition, despite a certain amount of erosion suffered on the beach. Also by the record by Mr. R. M. Johnston of *Arca trapezia*, Deshayes, as a Table Cape fossil, subsequently, however, expunged from the list.

117. Cardium septuagenarium, Tate.

Id., Tate, Lam. II., 1887, p. 151.

Id., R. M. Johnston, Geo. Tas., p. 234, pl. xxxii., figs. 1, 15 and 16.

118. Chione allporti, T. Woods.

Venus allporti, T. Woods, P.R.S.Tas., 1875, p. 26, pl. iii., fig. 10.

Chione allporti, Tate, Lam. II., 1887, p. 154.

Venus allporti, R. M. Johnston, Geo. Tas., p. 234, pl. xxxii., figs. 2 and 3.

119. Chione multilamellata, Tate.

Id., Tate, Lam. II., 1887, p. 154.

120. Chione hormophora, Tate.

C. (*Timoclea*) *hormophora*, Tate, P.R.S.Tas., 1884, p. 230, and Lam. II., 1887, p. 155, pl. xv., figs. 1*a*–1*b*.

121. Chione cainozoica, T. Woods.

C. cainozoica, T. Woods, P.R.S.Tas., 1876, p. 113.

C. cainozoica, Tate, Lam. II., 1887, p. 156, pl. xvi., figs. 3*a*–3*b*.

C. cainozoica, R. M. Johnston, Geo. Tas., p. 233, pl. xxxii., figs. 8, 8*a*, 11 and 11*a*.

122. Chione propinqua, T. Woods.

C. propinqua, T. Woods, P.R.S.Tas., 1876, p. 113.

Observations.—The specimens attributed to Tenison Woods' species by Professor Tate as occurring in the "lower and upper beds at Muddy Creek, but common in the latter only," do not in my opinion belong to the same species as the Table Cape specimens, and on that account the Victorian fossil, which is a very characteristic miocene form, stands in need of a name. In order to clear up the confusion surrounding this species I intend, in my next paper, to redescribe and rename the Victorian miocene fossil, with full particulars as to the points wherein it differs from the Table Cape species.

123. Cytherea tenuis, Tate.

C. tenuis, Tate, Lam. II., 1887, p. 159, pl. xiv., fig. 16.

C. eburnea ?, Johnston (non Tate), Geo. Tas., p. 233, pl. xxxii., figs. 9, 9*a*.

Observations.—The shell recorded and figured by Mr. R. M. Johnston as *Cytherea eburnea*, Tate, does not appear to be Professor Tate's species, but may probably represent *C. tenuis*, Tate.

124. Dosinia densilineata, sp. nov. Pl. IV., figs. 5, 6 and 7.

Shell orbicular, thin to thick, varying from about ·5 mm. or less in young shells to 3 mm. in thickness in the adult form; fairly convex, most marked in the umbonal region, maximum convexity situated about one-third the length of the umbo-ventral diameter from the dorsal margin in about the middle line of the shell. Umbones well defined, regularly convexly incurved obliquely towards the anterior end, from which they are situated about one-third the length of the shell.

Lunule elongate cordate, deeply depressed, finely and closely lamellose. The shell immediately anterior to the umbo and in

the neighbourhood of the lunule is markedly concave to a little beyond the lower end of the lunule, thence the anterior margin is regularly convex and protruding well forward before joining the convex ventral margin; post-dorsally flat on the dorsal surface, but the margin is slightly convexly rounded to meet the ventral margin with which it forms a very obtuse angle.

Externally the valves are ornamented with very numerous close-set concentric ridges, which are flat medially, but on account of being set somewhat obliquely appear slightly acutely elevated towards the umbo, becoming distinctly lamellose anteriorly and posteriorly, the lamellæ being directed towards the ventral margin and being most highly elevated along the posterior and anterior slopes of the valve. The concentric ridges become slightly broader towards the ventral margin, the intervening grooves are comparatively shallow and very much narrower than the ridges, usually considerably less than one-half their width, and becoming broader as the ridges become lamellose. The number of concentric ridges in more than half a dozen specimens of about the same dimensions as *Dosinia johnstoni*, Tate, namely, 29 mm. by 27 mm., average forty-nine in ten millimetres from the ventral margin; in specimens of larger dimensions they become gradually less in number, and in the largest specimen yet to hand, which measures 62 mm. by 57 mm., we have only eighteen concentric ridges.

Both ridges and grooves very finely, regularly, and closely concentrically striate, the striæ of the grooves becoming distinctly lamellose ventrally and laterally, usually more distinct at the posterior end. Internally the hinge is thick and strong in the adult form, with a well-defined and deep ligamental area post-dorsally; the hinge of the right valve bearing three strong cardinal teeth, the middle one being slightly bifid, whilst the posterior one is more distinctly so; there are also two rudimentary anterior lateral teeth at the base of the lunular area; the left valve also carries three strong cardinal teeth, the middle one only being slightly bifid, and one strong anterior lateral tooth. The pallial sinus is very broad at the base and deeply protruding into the shell horizontally and vertically beyond the centre of the valve, apex usually convexly rounded, occasionally acutely angular.

Dimensions.—Average dimensions of the Table Cape specimens: Antero-posterior diameter, 29 mm.; umbo-ventral diameter, 27 mm.; thickness through both valves, 15 mm.

Average dimensions of Spring Creek specimens:—Antero-posterior diameter, 50 mm.; umbo-ventral diameter, 45 mm.; thickness through single valve, 12·5 mm.

The largest specimen yet to hand is from the Spring Creek beds, which gives the following measurements:—Antero-posterior diameter, 62 mm.; umbo-ventral diameter, 57 mm.; thickness through the single valve, 15 mm.

Locality.—Eocene beds of Table Cape, Tasmania. Seven double valves and a single valve. Common in the lower eocene sandy beds of Spring Creek, near Geelong, and the lower beds of Maude, Moorabool Valley; also from the eocene limestone at Waurn Ponds (McCann's Quarry).

Observations.—This species is obviously closely related to *Dosinia johnstoni*, Tate, better proof of which we could not have than the fact that Professor Tate himself has recorded this very characteristic miocene species as occurring in the eocene beds of Table Cape and Spring Creek. The eocene and miocene shells seem to me however to be sufficiently distinct, after long and minute study, to warrant the description and the application of a new name to the eocene form.

In the first place, an important difference between the herein-described species and *D. johnstoni*, Tate, and one which the most casual observer can hardly fail to detect at first sight, is the very much closer, finer, and even more regular concentric ridging. In Professor Tate's description of *D. johnstoni* he states that the concentric ridges are "separated by linear deep sulci (about twenty in a breadth of ten millimetres measured from the ventral margin)." As the Table Cape shells are not very far removed in dimensions from those given by Professor Tate for *D. johnstoni*, they will serve as a reliable basis upon which the contrast of the concentric ornamentation may be indicated. These Tasmanian examples give an average of forty-nine grooves in the 10 mm. from the ventral margin as against the above. In the examination of the Table Cape examples a noticeable feature is that as the specimens increase in dimensions the concentric ridges tend to become slightly less in number. This latter feature

is still further brought out, and to a much more marked degree, by the larger shells from Spring Creek, thus in the largest specimens (62 mm. by 57 mm.) yet to hand from this locality we have only eighteen concentric ridges in the ten millimetres from the ventral margin. In addition, the lunule of *D. densilineata* is larger, longer and more depressed, the umbo is more markedly incurved and very much more inflated, and situated further back from the anterior margin. Viewed from the dorsal margin the outline is much more convex medially and flatter laterally. These characters seem to me ample to distinguish this shell as a good species. During the study of this species I have not neglected to compare it with many actual examples of living species of the genus. In the National Museum, Melbourne, there are upwards of forty species of Dosinia, which, through the kindness of Mr. W. Kershaw, I have had an opportunity of examining, and I take occasion now to tender him my best thanks. Of the living species hitherto examined, that which seems to me closest related to *D. densilineata*, particularly the larger Spring Creek representatives, is *D. lamellata*, Reeve, from North Australia, but our fossil species differs from this mainly in that the antero-posterior diameter is proportionately longer, and that the anterior and posterior slopes are flatter, these characters giving a very different aspect to the shell. Further, the lunule of *D. densilineata* is much longer and somewhat flatter, though about the same breadth, the umbo is more inflated, and the concentric ridging is stouter in the umbonal region and not finely lamellose as in the recent species; medially the ornament is somewhat similar in both the fossil and recent species, consisting of flat concentric ridges becoming distinctly lamellose laterally, also lamellosely ornamented near the ventral margin, but the intervening grooves are shallower in the fossil shell. Mr. T. S. Hall and I have also recorded this species as *D. johnstoni* from the eocene beds of Maude, and I now take this opportunity of correcting that record. In view of the above it should now stand as *D. densilineata*. A further point worthy of note in a Tasmanian representative of this species lent me by the Ballarat School of Mines is that when somewhat slightly decorticated exceedingly fine, close, and regular radial riblets are rendered visible. I have also been able to determine with certainty this

feature in some of the Victorian shells, but owing to their good state of preservation it is rarely noticeable; on the other hand, even with worn and decorticated examples of *D. johnstoni*, I have hitherto been entirely unable to detect anything of this kind in that species. The type of this species is in my own collection.

125. **Tellina cainozoica**, T. Woods.

Id., T. Woods, P.R.S.Tas., 1876, p. 113.
Id., Tate, Lam. II., 1887, p. 164, pl. xviii., fig. 5.

126. **Zenatiopsis fragilis**, sp. nov. Plate IV., figs. 3 and 4.

Shell very thin and fragile, elongate oblong, much depressed, anterior end very short, posterior end much elongated.

Dorsal margin straight or slightly concave, anterior margin regularly convex to about the anterior extremity, still convex but more gradually so to meet the ventral margin, which is straight or slightly convex and parallel to the dorsal margin from a point slightly posterior to a line passing through the umbo for a distance slightly in excess of half the full length of the shell, thence the margin has a more gradual slope up to the posterior extremity than at the anterior end, thence more rapidly convex to join the dorsal margin. Anterior gape commences immediately anterior to the umbos, while the posterior gape commences slightly posterior to the umbos, the ventral margins of the valves being in contact. Valves very slightly convex, greatest convexity situated at the intersection of the antero-posterior diameter and a line perpendicular to it and passing through its middle point; from this point the convex slope is more marked dorsally than ventrally and only just appreciable anteriorly and posteriorly. Umbo, though small, is prominent, acute and incurved, and situated about one-sixth the length of the shell from the anterior extremity. Surface ornamented with numerous shallow concentric corrugations of the shape above indicated, and fine, close-set, concentric striations, with a few very faint radial striations from the umbo posteriorly.

Dimensions.—Type, antero-posterior diameter, 33 mm.; dorso-ventral diameter, 12 mm.; thickness through both valves, 4 mm. Largest specimen yet to hand measures 46 mm. by 17 mm., with a thickness through both valves of 7 mm.

Locality.—Eocene beds of Table Cape, Tasmania. Two double valves and a right valve.

Observations.—This species has been confounded by Mr. R. M. Johnston (Geo. Tas., p. 233) and Professor Tate (Lam. II., 1887, p. 172) with *Zenatiopsis angustata*, Tate, from which however it may be distinguished by its much greater delicacy, its different shape, straight or concave dorsal margin, parallel ventral margin, and the absence of the general posterior attenuation present in that species.

127. Myodora australis, R. M. Johnston.

Id., R. M. Johnston, P.R.S.Tas., 1879, p. 40.

Id., Tate, Lam. II., 1887, pp. 174, 175, pl. xvii., figs. 10*a*, 10*b*.

128. Myodora brevis, Sowerby.

Pandora brevis, Sowerby, App. to Stutchbury's Sale Cat., p. 3, fig. 2.

Myodora brevis, E. A. Smith, Voy. Chall. Zoo., vol. xiii., 1885, Lamellibranchs, p. 64.

Myodora æquilateralis, R. M. Johnston, P.R.S.Tas., 1879, p. 40.

Myodora æquilateralis, Tate, Lam. II., 1887, p. 176, pl. xvii., fig. 8.

129. Corbula ephamilla, Tate.

C. sulcata, McCoy (non Lamarck), A.M.N.H., 1866, and Exhibition Essay, 1866, p. 19.

C. sulcata, T. Woods (non Lamarck), P.R.S.Tas., 1874, p. 16.

C. ephamilla, Tate, P.R.S.Tas, 1884, pp. 213 and 229; also Lam. II., 1887, p. 176, pl. xvii., figs. 13*a*–13*c* and 14.

Observations.—Sir Frederick McCoy states of this species:—"The only other excessively common living species of shell in our miocene or oligocene beds is the *Corbula sulcata*, Lam., of the tropical seas of the west coast of Africa, whence I have procured living specimens, so that, as in the other cases of identity of species spoken of, I might not run the chance of misleading my readers by erroneous identifications based on comparisons with figures or descriptions only." Professor Tate, however, in the face of this very clear decision, says, when naming and describing our fossil, he has "no means of ascer-

certaing what amount of reliance is to be placed on McCoy's determination."

In the National Museum, Melbourne, there are six specimens labelled *Corbula sulcata*, Lam., from the west coast of Africa, which are most likely to be the specimens above mentioned by Sir F. McCoy. Through the kindness of Mr. W. Kershaw, of the Museum, I have been enabled to examine these specimens closely and compare them critically with actual examples of our fossil species, and I have no hesitation in expressing that in my opinion our common and widely ranging fossil is specifically distinct from *C. sulcata*, Lam., and therefore, as far as the present investigation goes, *C. ephamilla*, Tate, should stand for our fossil.

130. Panopæa agnewi, T. Woods.

Lyonsia agnewi, T. Woods, P.R.S.Tas., 1875, p. 25, fig. 13.
Panopæa agnewi, Tate, Lam. II., 1887, p. 179.

131. Solecurtus legrandi, T. Woods.

S. legrandi, T. Woods, P.R.S.Tas., 1875, p. 25, fig. 14.
S. legrandi, Tate, Lam. II., 1887, p. 181, pl. xvii., fig. 15.
S. legrandi, R. M. Johnston, Geo. Tas., p. 233, pl. xxxii., fig. 18.

BRACHIOPODA.

132. Waldheimia grandis, T. Woods.

W. grandis, T. Woods, Trans. Phil. Soc. S.A., 1865, pl. ii., fig. 1.
W. gambierensis, R. Etheridge, jun., A.M.N.H., 1876, vol. xvii., p. 19, pl. ii., fig. 4.
W. grandis, Tate, Trans. Phil. Soc. S.A., 1880, p. 13, pl. xi., figs. 3 and 4.

133. Waldheimia garibaldiana, Davidson.

Terebratula, sp., Sturt, Two Expeditions in S.A., vol. ii., pl. iii., fig. 15, 1834.
Terebratula compta, T. Woods (non Sowerby), Geo. Obs. in S.A., p. 74, wdct., 1862.

Waldheimia garibaldiana, Davidson, Geologist, vol. v., p. 466, pl. xxiv., fig. 9, 1862.

Waldheimia imbricata, T. Woods, Trans. Phil. Soc. S.A., 1865, fig. 3, and P.R.S.N.S.W., 1878, p. 79, fig 1.

Waldheimia garibaldiana, R. Etheridge, jun., A.M.N.H., vol. xvii., p. 17, pl. i., fig. 2, 1876.

Waldheimia macropora, McCoy, Prod. Pal. Vic., Dec. V., pl. xliii., figs 4 and 6.

Waldheimia garibaldiana, Tate, Trans. Phil. Soc. S.A., 1880, p. 7, pl. xi., figs. 1*a*–1*c*.

Waldheimia garibaldiana, Johnston, Geo. Tas., p. 232, pl. xxxiii., fig. 13.

134. Terebratula vitreoides, T. Woods.

T. vitreoides, T. Woods, P.R.S.N.S.W., 1878, p. 78, figs. 4*a*–4*d*.

T. vitreoides, Tate, Trans. Phil. Soc. S.A., 1880, p. 5, pl. viii., figs. 5*a*, 5*b*, and pl. x., figs. 7*a*, 7*b*.

T. vitreoides, Johnston, Geo. Tas., p. 232, pl. xxxii., fig. 14.

135. Terebratulina scoulari, Tate.

T. scoulari, Tate, Trans. Phil. Soc. S.A., 1880, p. 19, pl. viii., figs. 3*a*–3*d*.

T. scoulari, Johnston, Geo. Tas., p. 232, pl. xxxiii., fig. 2.

136. Terebratella tepperi, Tate.

T. tepperi, Tate, Trans. Phil. Soc. S.A., 1880, p. 21, pl. ix., figs. 8*a*–8*c*.

T. tepperi, Johnston, Geo. Tas., p. 232, pl. xxxiii., fig. 6.

137. Magasella compta, Sowerby.

Terebratella compta, Sowerby, in Strezlecki's Phys. Desc. of N.S.W., etc., 1845, p. 297, pl. xix., fig. 4.

Terebratella compta, T. Woods, Trans. Phil. Soc. S.A., 1865, fig. 4, *a*—*e*.

Terebratella compta, R. Etheridge, jun., A.M.N.H., 1876, p. 19, pl. ii., fig. 5.

Magasella compta, Tate, Trans. Phil. Soc. S.A., 1880, p. 23, pl. x., figs. 6*a*–6*e*.

Magasella woodsiana, Tate, *op. cit.*, pp. 24, 25, pl. x., figs. 3*a*–3*d*.

Observations.—This is a somewhat variable species, and after examining 162 specimens from various localities I cannot see that any useful purpose is served in retaining *M. woodsiana* as specifically distinct from the other forms, as there are so many gradations between them that it becomes a matter of impossibility to separate them into two distinct species.

138. Rhynchonella squamosa, Hutton.

R. squamosa, Hutton, Cat. Tert. Moll. N.Z., p. 37, 1873.

R. lucida, McCoy, etc., non. Gould, see R. Etheridge, jun., Cat. Austr. Foss., 1878, p. 151.

R. squamosa, Tate, Trans. Phil. Soc. S.A., 1880, p. 27, pl ix., figs. 9*a*, 9*b*, also Trans. Roy. Soc. S.A., 1885, p. 94.

R. squamosa, Johnston, Geo. Tas., p. 233, pl. xxxiii., fig. 12.

ECHINODERMATA.

139. Conoclypeus rostratus, Tate.

C. rostratus, Tate, P.R.S.N.S.W., 1893, p. 194, pl. xiii., fig. 1.

140. Lovenia forbesi, Woods and Duncan.

Var. *woodsi*, R. Etheridge, jun.

Spatangus hoffmanni, Sturt (non Goldfuss), Two Exped. in S.A., 1834, pl. iii., fig. 10.

Spatangus, sp., Forbes, "Lectures on Gold," etc., London, D. Bogue, 1852.

Spatangus forbesi, McCoy, M.S.

Hemipatagus forbesi, McCoy, M.S.

Spatangus forbesi, T. Woods, Geo. Obs. in S.A., 1862, p. 75, woodcut.

Hemipatagus forbesi, Woods and Duncan, A.M.N.H., 1864, ser. 3, vol. xiv., p. 165, pl. vi., fig. 3, *e*–*f*.

Hemipatagus forbesi, Laube, Akad. d. Wiss. Wien, 1869, vol. lix., p. 193, figs. 4–4*b*.

Hemipatagus woodsi, R. Etheridge, jun., Q.J.G.S., 1875, vol. xxxi., p. 445, pl. xxi., figs. 1, 7.

Hemipatagus woodsii, Johnston, P.R.S.Tas., 1876, p. 116.

Lovenia forbesi, Woods and Duncan, Q.J.G.S., 1877, vol. xxxiii., p. 56, pl. iv., figs. 5 to 8.

Lovenia forbesi, McCoy, Prod. Pal. Vic., Dec. VI., 1879, pp. 37–40, pl. lx., figs. 1–4.

Sarsella forbesi, Pomel, Theses par A. Pomel, Class. method. Ech. viv. et foss., Alger, 1883, p. 28.

Lovenia forbesi, Woods and Duncan, Q.J.G.S., 1887, vol. xliii., pp. 424 to 426.

Observations.—This very common echinoid has given rise to more controversy and difference of opinion than any other of the Australian Tertiary Echinoids, and as a consequence there is still a great amount of confusion existing as to its correct generic position, and as to the rightful author of the specific name. With regard to the latter nothing could be more clearly expressed than Professor P. M. Duncan's views on the subject in 1887, where it is distinctly shown that Woods and Duncan should be regarded as the authors of the species, Professor Duncan himself including T. Woods' name on account of the assistance rendered to him by the latter when describing the species. Sir F. McCoy states "that it is impossible to divide this species into two as suggested by Mr. Etheridge, jun. (*L. woodsi* and *L. forbesi*), from the number of primary tubercles in the posterior lateral interambulacra, although I notice that those with the more numerous tubercles are more common in the Murray Cliffs and more rare near Melbourne, and that they are less pentagonal from a slightly greater proportional length and less protuberant sides, and have the apex usually farther from the posterior end and the posterior ridge stronger." The form of this species occurring at Table Cape comes in the same group as the specimens from the River Murray Cliffs.

141. Cyclaster archeri, T. Woods.

Echinolampas, sp., T. Woods, Geo. Obs. in S.A., 1862, p. 77, woodcut.

Hemiaster archeri, T. Woods, Trans. Phil. Soc. S.A., 1867, figs. *2a–2d*.

Micraster brevistella, Laube, Akad. d. Wiss. Wien, 1869, vol. lix., p. 192, fig. 8

Micraster brevistella, R. Etheridge, jun., Q.J.G.S., 1875, vol. xxxi., p. 447, figs. 11 and 12.

Micraster brevistella, Johnston, P.R.S.Tas., 1876, p. 116.

Brissopsis archeri, Tate, T.R.S.S.A., 1884, p. 41.

Micraster archeri, Tate, T.R.S.S.A., 1891, p. 277.

Cyclaster lycoperdon, Bittner, Akad. d. Wiss. Wien, 1892, p. 360, pl. iv., figs. 1, 2.

? Cyclaster morgani, Cotteau (*fide* Tate).

ZOANTHARIA.

142. **Flabellum distinctum**, Edwards and Haime.

143. **Placotrochus deltoideus**, Duncan.

144. **Deltocyathus italicus**, Edwards and Haime.

List of species recorded from Table Cape in addition to the foregoing. Those marked with an asterisk seem to me to require confirmation, and those marked † I have seen from the Ballarat School of Mines Museum.

CEPHALOPODA.

1. Aturia australis, McCoy.

GASTROPODA.

†2. Murex camplytropis, Tate.
3. Murex legrandi, Johnston.
4. Triton crassicostatus, Tate.
5. Epidromus tasmanicus, Johnston (Triton).
6. Fusus craspedotus, Tate.
7. Fusus dictyotis, Tate.
*8. Buccinum fragile, T. Woods.
*9. Voluta allporti, Johnston.
*10. Voluta agnewi, Johnston.
*11. Voluta hannafordi, McCoy (V. alticostata, Tate, may have been mistaken for this species).
*12. Voluta macroptera, McCoy.
13. Marginella octoplicata, T. Woods.
14. Marginella wentworthi, T. Woods.

15. Marginella micula, Tate, var.
†16. Ancillaria hebera, Hutton.
17. Columbella cainozoica, T. Woods.
18. Columbella oxleyi, T. Woods.
19. Cancellaria etheridgei, Johnston.
20. Terebra simplex, T. Woods.
21. Bela pulchra, Tate.
22. Pleurotoma pullulascens, T. Woods.
23. Pleurotoma sanderloides, T. Woods.
24. Mangelia gracilirata, T. Woods.
†25. Borsonia marginata, T. Woods (Thala).
*26. Cypræa eximia, G. B. Sowerby.
27. Trivia avellanoides, McCoy (syn., T. europæa, T. Woods, &c., non Montfort, T. minima, T. Woods).
28. Erato minor ?, Tate.
29. Erato duplicata, Johnston.
30. Crepidula hainsworthi, Johnston.
31. Calyptropsis umbilicata, Johnston, sp. (syn., Crepidula umbilicata, Johnston).
32. Crossea sublabiata, Tate (syn., Crossea labiata, T. Woods).
33. Scalaria (Acrilla) inornata, Tate.
34. Turritella tristira, Tate.
35. Turritella acricula, Tate.
36. Thylacodes conohelix, T. Woods (Vermetus).
37. Leiostraca johnstoniana, Tate (syn., Eulimella subulata, T. Woods, non Donovan).
38. Turbonilla pagoda, T. Woods.
39. Turbonilla liræcostata, T. Woods.
40. Odostomia microlirata, Johnston (syn., Syrnola bifasciata, T. Woods).
41. Mathilda transenna, T. Woods (Turritella).
42. Pyramidella roberti, T. Woods.
43. Pyramidella sulcata, Johnston.
44. Pyramidella polita, Johnston.
45. Rissoa stevensiana, T. Woods.
46. Rissoina varicifera, T. Woods.
47. Rissoina johnstoni, T. Woods.
48. Rissoina tateana, T. Woods.

49. Liotia roblini, Johnston (syn., Liotia discoidea, T. Woods, non Reeve).
50. Adeorbis lævis, Johnston.
51. Gibbula crassigranosa, T. Woods.
52. Gibbula clarkei, T. Woods.
53. Cantharidus ? josephi, T. Woods (Trochus).
54. Eumargarita keckwicki, T. Woods (Margarita).
55. Calliostoma blaxlandi, T. Woods (Zizyphinus).
56. Calliostoma atomus, Johnston (Zizyphinus).
57. Euchelus woodsii, Johnston.
58. Delphinula tetragonostoma, T. Woods.
59. Megatebennus malleata, Tate (Fissurellidæa), (syn., Fissurella concatenata, T. Woods, non Crosse).
60. Emarginula transenna, T. Woods.
61. Actæon scrobiculata, T. Woods.
62. Ringicula lactea, Johnston.

LAMELLIBRANCHIATA.

63. Pecten polymorphoides, Zittel.
64. Pecten lucens, Tate.
65. Pecten (Amusium) zitteli, Hutton (syn., Amusium atkinsoni, Johnston).
66. Limea transenna ?, Tate (syn., ? Cucullæa minuta, Johnston).
*67. Spondylus pseudoradula ?, McCoy.
68. Crenella globularis, Tate.
69. Nucula atkinsoni, Johnston (Portlandia).
70. Nucula fenestralis, Tate.
71. Leda huttoni, T. Woods.
72. Leda prælonga, Tate.
73. Leda apiculata, Tate.
*74. Limopsis aurita, Brocchi (probably L. insolita, Sow.).
75. Limopsis belcheri, Adams and Reeve.
76. Arca pseudonavicularis, Tate.
77. Barbatia celleporacea, Tate.
78. Trigonia tubulifera, Tate.
79. Crassatella communis, Tate (syn., C. astartiformis, Tate).
80. Carditella lamellata, Tate.

*81. Cardita trigonalis, Tate.
82. Cardium pseudomagnum, McCoy.
83. Chione dimorphophylla, Tate.
84. Cytherea eburnea, Tate.
*85. Psammobia hamiltonensis, Tate.
86. Psammobia æqualis, Tate.
87. Phragmorisma anatinæformis, Tate.
88. Aspergillum, sp.

BRACHIOPODA.

89. Waldheimia furcata, Tate.
90. Waldheimia johnstoniana, Tate.
91. Waldheimia corioensis, McCoy.
92. Waldheimia pectoralis ?, Tate.
93. Waldheimia tateana, T. Woods.
94. Waldheimia taylori, R. Etheridge, jun.
95. Terebratulina lenticularis, Tate.
96. Terebratulina triangularis, Tate.
97. Terebratulina davidsoni, R. Etheridge, jun.
98. Terebratella woodsii, Tate.

ZOANTHARIA.

99. Flabellum duncani, T. Woods.
100. Flabellum gambieriense, Duncan (syn., ? F. pedicellare, Tate).
101. Flabellum victoriæ, Duncan.
102. Placotrochus elongatus ?, Duncan.
103. Notocyathus excisus, Duncan (Sphenotrochus).
104. Notocyathus viola, Duncan (Caryophyllia).
105. Conotrochus maccoyi, Duncan.
106. Heliastræa tasmaniensis, Duncan.
107. Antillia lens, Duncan.
108. Thamnastræa sera, Duncan.
109. Thamnastræa tasmaniensis, Duncan ?.
110. Palæoseris woodsi, Duncan (Trochoseris)
111. Balanophyllia australiensis, Duncan.
112. Dendrophyllia duncani, T. Woods.
113. Dendrophyllia epitheca, T. Woods.
114. Astrangia tabulosa, Tate.

P.S.—The Geological Survey of Victoria subdivided the Spring Creek beds, near Geelong, into three, and applied the terms Lower, Middle, and Upper Miocene to these subdivisions. The examinations of this section made by Mr. T. S. Hall and myself enable us to recognise at present only two distinct palæontological zones, and we are of the same opinion as Messrs. Tate and Dennant that the Survey's so-called upper beds cannot be separated from their middle beds. I draw attention to the above in order that there may be no misinterpretation of the earlier portion of this paper, where I have referred to the so-called middle beds at Spring Creek and their probable equivalents, the clay beds of this portion of the section at Spring Creek having yielded a very fair collection of gastropods and lamellibranchs, which has very materially assisted in determining its equivalents elsewhere.

EXPLANATION OF PLATES.

Plate II.

Fig. 1.—Voluta halli, sp. nov., adult specimen, natural size.
„ 2.—Voluta halli, young example, natural size.
„ 3.—Voluta halli, embryonic whorls of an unusually tumid young example, natural size.
„ 4.—Peristernia murrayana, var. costata, nov., natural size.
„ 5.—Latirofusus cingulata, sp. nov., twice natural size.
„ 6.—Latirofusus cingulata, enlarged ornament.
„ 7.—Trophon selwyni, sp. nov., natural size.
„ 8.—Lyria semiacuticostata, sp. nov., natural size.
„ 9.—Terebra prægracilicostata, sp. nov., twice natural size.
„ 10.—Peristernia semiundulata, sp. nov., natural size.
„ 11.—Peristernia semiundulata, enlarged ornament.
„ 12.—Pleurotoma wynyardensis, sp. nov., natural size.
„ 13.—Pleurotoma wynyardensis, enlarged ornament.

Plate III.

Fig. 1.—Voluta atkinsoni, sp. nov., adult specimen, natural size.
„ 2.—Pyrula altispira, sp. nov., front view, natural size.

Fig. 3.—Pyrula altispira, back view of smaller specimen, natural size.

„ 4.—Tugalia crassireticulata, sp. nov., dorsal aspect, natural size.

„ 5.—Tugalia crassireticulata, side view, natural size.

„ 6.—Drillia crenularoides, sp. nov., natural size.

„ 7.—Drillia crenularoides, enlarged ornament.

„ 8.—Delphinula imparigranosa, sp. nov., back view, twice natural size.

„ 9.—Delphinula imparigranosa, umbilical aspect, twice natural size.

„ 10.—Calliostoma latecarina, sp. nov., back view, twice natural size.

„ 11.—Calliostoma latecarina, front view, twice natural size.

„ 12.—Turbo atkinsoni, sp. nov., natural size.

Plate IV.

Fig. 1.—Voluta spenceri, sp. nov., adult specimen, natural size.

„ 2.—Voluta spenceri, embryonic whorls of another specimen, natural size.

„ 3.—Zenatiopsis fragilis, sp. nov., left valve, natural size.

„ 4.—Zenatiopsis fragilis, right valve of smaller example, natural size.

„ 5.—Dosinia densilineata, sp. nov., left valve, natural size

„ 6.—Dosinia densilineata, front view of double valves, natural size.

„ 7.—Dosinia densilineata, right valve of large example, natural size.

„ 8.—Cypræa platyrhyncha, var. angustior, nov., dorsal aspect, natural size.

„ 9.—Cypræa platyrhyncha, var. angustior, nov., ventral aspect, natural size.

„ 10.—Actæon puteolata, sp. nov., front view, four times natural size.

„ 11.—Actæon puteolata, back view, four times natural size.

„ 12.—Actæon puteolata, embryo enlarged.